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How Big Mining Co's Protect Their Plants

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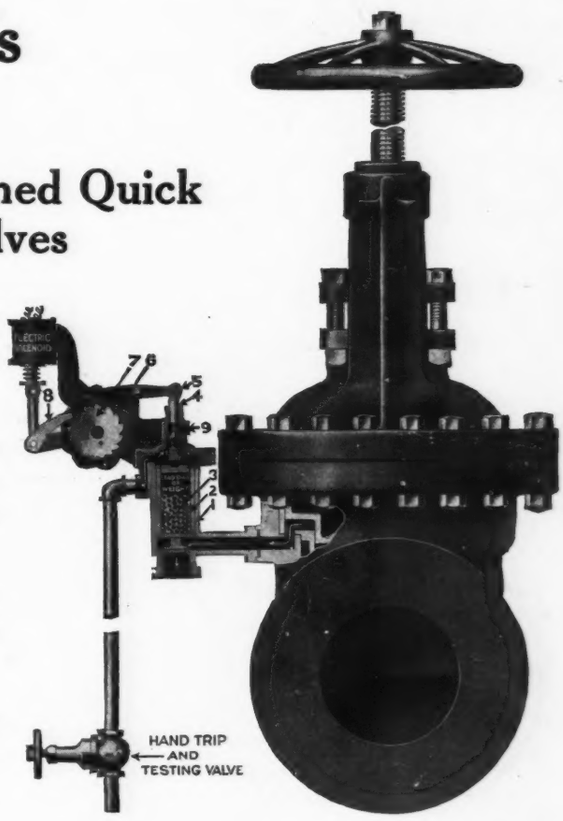

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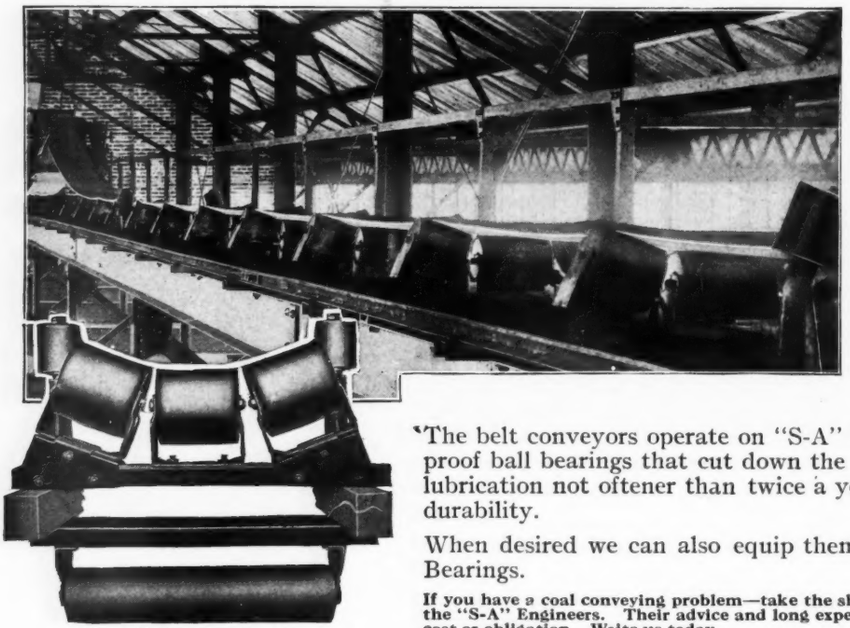

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Engineering and Mining Journal

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Gold Dredging in Tierra Del Fuego

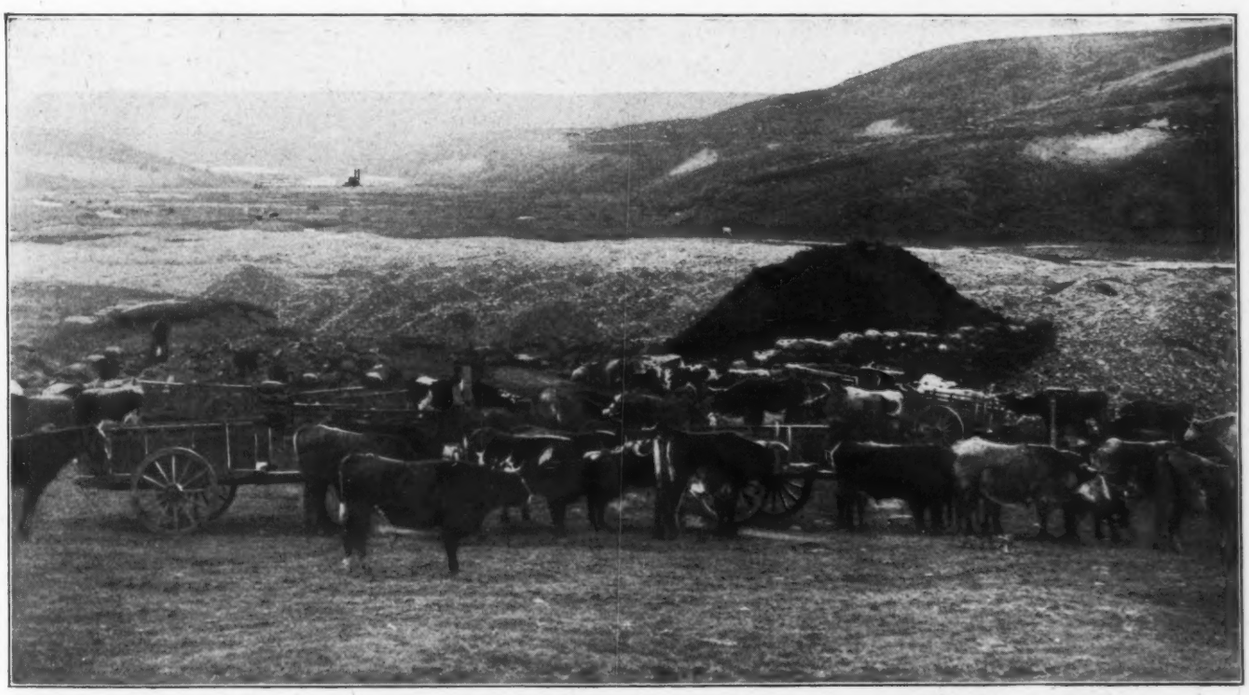
By Lyman Chatfield*

SYNOPSIS—Conditions in the Chilean section of the archipelago of Tierra del Fuego are described, with special reference to the possibilities in dredging the gold-bearing river beds, which the author believes can be handled with good profit if undertaken by strong organizations. Gravels contain little clay and few boulders; gold contents range from 15 to 44c. per cu.m. Climate dreary, but cold is not severe. Only two dredges now operating, though 14 or more have been erected since the opening of this field.

Separated from the great mainland of South America by the Magellan Straits lies the large archipelago, Tierra del Fuego. It is not my idea to enter into exhaustive detail regarding the geography and topography of this region, but to describe briefly in a general way this little-known land should be of some interest to the reader.

The group lies between 52° 40′ and 55° 58′ south latitude and 63° 28′ and 74° 36′ west longitude, stretching southeasterly nearly in a line with the Patagonian Andes for about 425 miles. The archipelago is divided into three main sections, known as East, West and South Fuegia. East Fuegia is the largest of the three, having an extent of about 200 miles from north to south. Here the slightly rolling plains are covered with a rich growth of tall herbage, upon which feed the guanaco and other animals known on the mainland. In the south a long irregular peninsula projects westward to the Pacific. This western portion is mountainous in character. Among the many peaks are Mount Darwin, which reaches a height of 6852 ft., and Mount Sarmiento, 7110 ft.

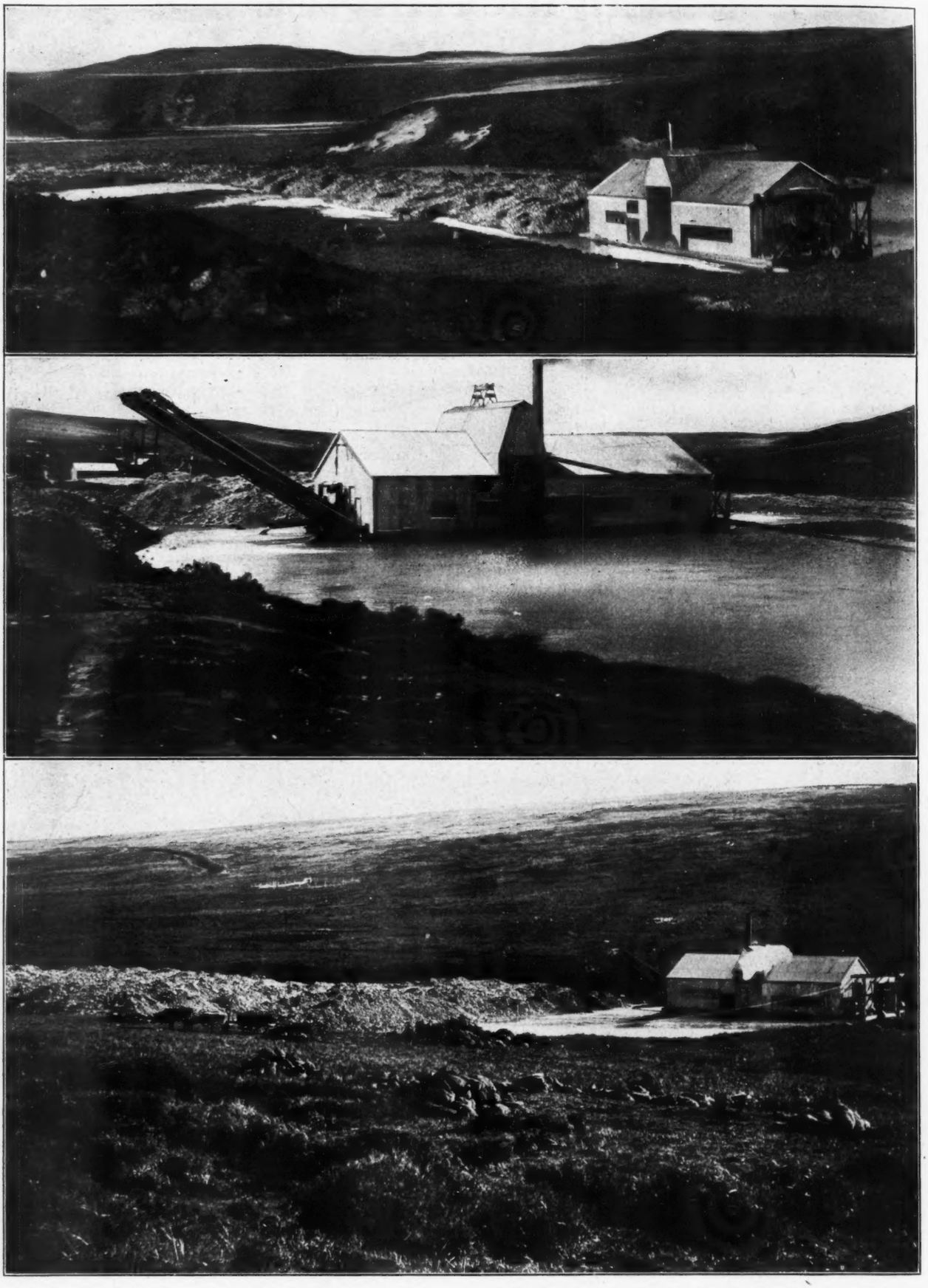
Both West and South Fuegia are mountainous, as they lie in a line with the main Andean axis. The mean elevation is about 3085 ft., and the vegetation is arboreal instead of grassy. The mean temperature is about 42° F. The isothermals of 32° F. for July (winter) and 50° F. for January (summer) show that fairly mild winters are followed by cool summers. The cloudy skies, the sudden changes from fair to bad weather, the high winds and snowstorms all tend to make this region one of the dreariest on the face of the earth.



VALLEY OF THE RIO VERDE IN CHILEAN TIERRA DEL FUEGO

Oxen and carts are used to transport supplies from the port of Porvenir to the dredges. The black pile in front of the dredge tailing is peat which occurs in the overburden in much of this dredging field

*Mining engineer, Plaza Hotel, Buenos Aires.



DREDGING FOR GOLD IN THE TIERRA DEL FUEGO

The upper view shows a 5-cu.ft. dredge that is operating in the Rio del Oro Valley; the next view is also in the Rio del Oro. The bottom view shows a dredge in the Rio Progreso—bags in foreground contain coal brought from Puntas Arenas

These three division of Tierra del Fuego are inhabited by three distinct groups of Indians; the Onas of the East, the Yaghans of the South and the Alacalufs of the West. The total number of these Indians probably does not exceed 5000 throughout the whole archipelago. They rarely come in contact with one another and all are of a low type, possessing scarcely any intelligence, and they are cruel and filthy to the last degree. It is stated that the old women among the Yaghans are oftentimes put to death and eaten by the other members of the family. They have not a tribal government, each family living by itself. A general chief is not recognized by any of these families.

A part of Tierra del Fuego belongs to Argentina, and the other part is owned by the republic of Chile. There has been some trouble over the boundary line in years past, but I believe that this has now been settled in a manner satisfactory to both governments.

As my investigations have been limited to that part of Tierra del Fuego belonging to Chile, I shall have little to say regarding the gold-bearing alluvials belonging to Argentina. It is interesting to note what little mention is given to this region in the bulletin, "La Geologia y Mineria Argentinas," published in 1915 by the Director General of Mines of Argentina, E. Hermitte. I quote the following extract:

> There are also outcrops of gold, in the region of the Straits of Magellan, usually in the form of alluvial; there are, however, some quartz veins which are known to contain gold. The greater part of the alluvial deposits are found in Chilean territory, and a great deal of work has been done, but the results are not good owing to the lack of proper studies being made as to the conditions, and failure to operate on a business-like basis.

Gold in Verde, Oscar, Progreso and del Oro Rivers

After a careful study of the region and existing conditions, I agree with Señor Hermitte on his summing up of the situation. There is without question sufficient gold in the gravels of the Rio del Oro, Rio Verde, Rio Oscar and Rio Progreso to make dredging operations profitable. It is needless to say that the work must be carried on under first-class engineers, backed by a strong organization such as one finds in New Zealand, Australia, California and other parts of the world. It is not surprising to find that many failures have been made in this region when one considers the shiftless manner in which work has been conducted.

At present there are 14 dredges in Tierra del Fuego and only two of them are operating. All these dredges are of the New Zealand type, loose-connected and operating with cables. They are quite different from the close-connected spud-type dredges used in the United States.

Few Boulders and Bedrock Is Soft Sandstone

In the Rio del Oro, Rio Verde and Rio Oscar, conditions are especially favorable for dredging operations. Dredges may be built and floated in any part of these rivers, and from the port of Porvenir there is a good cart road over which material and supplies may be transported. There is an ample water supply, and floods are unknown. The rivers are not large, and paddocks must be built to receive the dredge. They range in width from 30 to 140 ft., and the depth in the different rivers varies from 1 to 7 ft.

The gravels contain few boulders, and there is no buried timber. I should say that a set of grabhooks in the bucket chain would take care of any boulders that might be found. The depth of the gravel varies from 5 to 30 ft., having an ideal bedrock of soft sandstone. Thus the gravel could be dredged right down to bedrock and the bedrock scraped; in this manner all the gold settling down toward bedrock during the dredging could be taken out and saved. Owing to the nature of these rivers, when operations for deep dredging are going on, the water in the paddock could be lowered from 2 to 7 ft., thus allowing the dredge to do the same work with a much shorter ladder. This would save a great deal of wear and tear on the dredge, as long ladders are much harder on the working parts than short ones.

The overburden in this district consists of peat, varying in depth from 2 to 15 ft. An average depth of the peat along the rivers would not be more than 3½ ft., however. This peat is of good quality and may be utilized as fuel either in the form of briquets or in gas producers. There is also a mine of good lignite a short distance from the Rio Verde.

I found no gravel in this district that required blasting, and from inquiries made among the old residents, I found that the cold was never severe enough to cause more than surface freezing. There are no bad clay seams in the gravel; that is to say, the small blankets of clay were not of enough importance to justify serious consideration as to loss of gold in being carried out by way of the elevator.

As previously stated, the winters are not severe enough to affect dredging operations materially. At the outside, it would not be necessary to cease operations for more than 11 weeks, and this need not be considered all time lost, as a careful distribution of overhauling periods will minimize the actual loss of time.

The accompanying table shows the results of test shafts put down on these rivers. All are averages, and the ground measurements are in meters. I am in a position to vouch for the results given and am confident that dredges, properly handled, in this field would amplify them.

TEST SHAFTS IN RIVERS OF TIERRA DEL FUEGO

	No. of Shafts	Depth in Meters	Peat	Gravel	Gold per Cubic Meter Grams	Cents
Rio Verde						
Lower section..	15	4.36	1	3.36	0.264	15.85
Upper section..	24	4.31	0.90	3.41	0.742	44.52
Rio del Oro.....	..	....	...	....	.....	19.80
Rio Oscar.....	...	....	...	....	.....	17.66
Rio Progreso.....	..	....	...	....	.....	20.87

The Deister Plateau

In the case of the suit against the Deister Machine Co, by the Deister Concentrator Co., in which it was charged that the former infringed the patents of Overstrom, owned by the latter, in the use of a wedge block interposed between the riffles and the table deck, forming an inclined surface and a flat plateau, a judgment was rendered in January.

The case was an appeal tried before Judges Kohlsaat, Mack and Altschuler in the United States Circuit Court of Appeals for the Seventh Circuit. The decision upholds the lower court in that Deister's plateau does not infringe Overstrom's patent. The court avoided, however, expressly determining that the Overstrom patent is invalid.

The decision in this case is of interest to the metallurgical profession because of the use that has been made of the plateau principle in many instances. Experiments are being made with the device on a large scale.

Organization of Mine Labor on the Witwatersrand

By E. M. Weston*

SYNOPSIS—Both the white and the native laborers employed underground on the Rand are generally inefficient. A mixture of both accentuates the faults of each. Results can be obtained only by careful organization and skilled staff superintendence. Causes and results of inefficiency are discussed, instances given, and outlines of organization problems presented.

The organization of mine labor on the Witwatersrand, like the problem of obtaining efficient work from any class of labor in any part of the world, presents its own particular difficulties. When two classes of labor are employed, the task of obtaining a reasonable efficiency from both becomes doubly difficult. On the Witwatersrand this difficulty is further increaosed by several conditions peculiar to the country.

One of the chief of these is the scarcity of skilled, reliable and intelligent white workers. Anyone who was expected to obtain good results with the available labor realized this before the war called away many of the best men, and today the various mines are busy trying to rob one another of any good men they have. The causes that produced the shortage were the comparative isolation of the Rand from other mining regions and the effect of silicosis during the last 20 years. I suppose this disease has caused the death of at least 50,000 workers during that time, and it is only occasionally one meets a man who has survived for 15 or 20 years. Conditions underground have enormously improved, and a careful man should be able to survive for an indefinite period. The state of affairs is not yet ideal, and the following discussion shows why it is so difficult to make it so; but, taking everything into consideration, this field offers greater attraction to the skilled workman than most mining districts.

Labor Supply a Problem

The miner trained from youth up is dying out. The Cornish mines, which provided a great training ground, are being exhausted, and the spread of education there and elsewhere has apparently had the strange effect of discouraging men from entering the most interesting occupation in the world. On the Rand a training school in practical mining for youths of sixteen and upward has been established and is doing good work; but the attendance is much below what it should be, and the young colonial resents being taught to do what he calls "Kafir's work"—hand drilling and shoveling. Real miners are thus rare on the Rand. The white labor supply, such as it is, is supported mainly by recruits from the country, Dutch and English Africandese. These come to the mines as "learners"; they may have been anything from disrated attorneys to butchers and are often of small education and less intelligence. They are placed under a miner and paid anything from 5s. up per day. After a month or two, if they do not kill anyone or get blown up themselves, they are given a provisional blasting certificate, and later on they are allowed to obtain a government certificate permitting them to conduct blasting operations. This they get after paying a small fee and being subjected to an oral examination by a government official. They then blossom out as fully qualified miners. Some of them do learn something of simple driving and stoping, by practicing at the expense of the various mines in which they obtain their first jobs, and the rest join the great army of inefficient who flit too and fro between the various mines. Drunkenness is a common failing, and a general restlessness, extravagance and improvidence result from the high wages paid to single men.

Good Labor Scarce and Independent

The good miner who knows his work and is fairly reliable is the most independent man in the world. His maxim is that which an old coal-mining boss in the Kent valley in England propounded for the benefit of a youthful cadet under his charge: "Say, lad, if thee hast a good job, keep grumbling like hell and then nubbody will want it from thee." To exercise rigid discipline over such men as these is to cut one's own throat; they are eagerly welcomed at the next mine, and to dismiss an inefficient man is only to take a chance of getting someone worse. Mine officials have winked at breaches of the mining regulations for fear of losing good men, and are also tolerant in regard to an average man, in sheer despair of getting anyone better. The good men must have the best places in the mine because they will not work in more difficult places. Unskillful men are driven to work in such places, where their very lack of skill proves fatal to any chance of making money. High wages on contract can still be made by a skillful man, and as his services are in demand, he cares nothing for anyone or anything apart from his own interests.

Hence losses arise in a dozen ways. Not a man would lift a little finger to save anything belonging to the mine from destruction. After blasting, machines and gears are thrown down in the most convenient place and frequently get blasted or lost. In the backstopes of one deep-level mine it is said 50 rock drills disappeared within a short period. Some were buried and others shot to pieces. The supply of drill steel is a constant source of trouble. A miner working in development faces or stopes with machines has a native whose duty it is to bring in sharp steel from the station and remove blunt drills. Generally the miner takes no interest in this and, instead of having all blunts collected and taken out at blasting time and all sharps placed together, steel is left anywhere and everywhere. It is covered up along the sides of the drives or in the stope and is lost temporarily or totally. In a developing mine, just as soon as a shortage of labor occurs, the cleaning up falls behind and broken rock tends to accumulate along the sides of the drives. Drill steel, tightener bars, feet for the jack, blocks, arms, clamps, and even machines get lost. The average native shoveler loads anything he can lift into his truck, and much small gear goes to the waste dump. This dump should be examined morning

*Millsite, South Africa.

and evening, but this is seldom done. Drill steel even for large machines is often left lying on the floor of the drive and tracks are laid over it. The supply of drill steel gets short, and there is trouble all around.

Unless the underground officials are trained to *see* things underground, these losses mount up alarmingly. To appeal to the miners is useless. Sometimes native drill packers deliberately throw blunt steel down old winzes and stopes to save themselves the trouble of taking it to the shaft. Where work is going on over a large area, especially where there are several inclined surface shafts and winzes in an old mine and many old stopes and drives, the loss of steel for hand drilling is a serious and annoying problem. A native driller carries down two or three $\frac{7}{8}$-in. octogon drill steels up to 4 ft. long, and to save the trouble of carrying them up out of the mine, he throws one down a flooded winze or buries it under filling.

To check or prevent this loss requires constant care. Natives may have their tickets punched either on returning steel to the station, or they may have to take it to the sharpening shop themselves to have their tickets punched. Only those natives with punched tickets are given steel to drill with next day. This system does not work perfectly, for several reasons, and a constant search has to go on below for abandoned stuff. This is only a portion of the waste of material that goes on underground. Rock-drill operators or their natives persistently lose or break blocks, wedges, plugs, blowpipes and tamping sticks, and damage air and water hose.

A Remedy for Losing Tools by Laborers

One obvious remedy is to make laborers pay for lost materials. Some mines do this, and with marked air and water hose it can be managed successfully; but generally it merely makes things worse, as the careful and honest miner has to pay for the neglect of the opposite type, who takes care to steal from others what he has destroyed. It is impossible to build a tool box underground that cannot be broken open. If a man takes the trouble to get together a good set of tools, he has to take them to the surface to keep them. The underground manager has to provide just twice as many such tools as are really necessary or find the work delayed all round. Timbermen, platelayers, pipe fitters, etc., unless provided with the very strongest storerooms, come down to find that all the tools necessary for a day's work have vanished. These troubles are more apparent when working double shift, as the offender is harder to discover; but they occur under all conditions. Air hose is seldom drawn far enough away from blasting, and men have constantly to be dismissed for totally destroying it in this way, while water hose and jets last only half as long as they should.

Miners, as a rule, take little interest in the dust question. Water blasts, produced by connecting air and water pipes and turning on air and water after blasting, are a blessing in any mine, as they lay the dust and smoke, cool the air and absorb N_2O and CO_2. Their one fault is that they may lead to the flooding of winzes, air pumps and winches. This, however, can be prevented by placing a nonreturn valve of good design in the air pipe on the side toward the shaft. Mining regulations compel managers to install these valves in all development faces and require men to examine them before blasting, and to use them. Yet there are mines on the Rand today in which the miners persistently neglect to use them. Water provided for water blasts should be free from fine floating dust and should be maintained in the pipes at a pressure greater than that of the air. The quantity of water entering a 2-in. air pipe should be limited by inserting a $\frac{1}{8}$-in. or $\frac{3}{16}$-in. plug in the water pipe behind the cock connecting it with the air pipe. As an additional precaution against flooding of working places between blasting time and the next shift, an arrangement should be made to turn all water out of the pipe system 15 or 20 min. after blasting. If a water pipe be taken down a long flat winze, as on the East Rand, it is a favorite trick of the native to turn it on to get a drink and leave it turned on until it floods his winze.

The only pick used in the mines of the Rand is a double-pointed detachable one with armored handles. Of these there is a tremendous loss, as the heads are taken to use in the capstan screws of the double jack bars, where they soon get bent or broken. If special bars are provided for this purpose, they get lost or buried. The handles are the delight of Kafirs, who smuggle them up concealed in their trousers, to whittle down into battle axes for their native dances. They also steal any bright copper articles, such as nozzles for water sprays, and many have been injured trying to pick the filling out of detonators with which to make necklaces. Waste of nails and tools takes place everywhere. The timbermen, platelayers and pipe fitters, or their natives, scatter nails, bolts, dog spikes, pipe fittings and tools everywhere.

The Burden of Underground Supervision

The burden of supervision is thus most heavy on the underground manager. Even if he has shift bosses who *see* things, he himself knows that in a developing mine the one unpardonable sin is to reduce footage, and in a producing mine to allow the mill to go short, and is tempted to spend little time hunting down small matters. The shift boss usually has a long round and many things to attend to. He must keep up his tallies of rock to the shaft. The shift is short, the levels are long, boys are lazy and trammers slack. Trucks come off the rails and winches break down; so he mostly passes by on the other side, and small losses are overlooked in the end. Air and water pipes blasted, tracks not laid, bottoms of levels high, stope boxes blasted out, falls of hanging, natives not turned out to work, rock drills broken down and not sent up for repair, men absent, dumb, or sick—all these matters rise up to worry him, and he is only human after all. Efficient shift bosses also are not found every day. It is astonishing what a man who is not trained to look will miss seeing underground, and a mine-blind shift boss is worse than useless.

The lack of experience in never having performed an honest day's work with pick and shovel handicaps the class of white workers who are set to supervise the natives doing this work in the Rand mines. Not one in ten knows how to handle a shovel or pick or can teach the natives right methods. This leads to the unnecessary rehandling of millions of tons of rock. As a rule, they are incapable of doing the simple work of laying a temporary track, but need a skilled tracklayer to do it for them. If skilled whites performed this work, they would see that short lengths of rail were always available and that they were kept advanced in development ends so that only one handling of rock broken in the face would be required to place it in the truck. Under existing conditions the

management does not always provide these conveniences, and if it does they are left too near the face and get bent. The machine man steals the iron sleeper holding it together to rig his double jack bar, or the trammer is too ignorant or lazy to lay it; hence one constantly sees six natives shoveling rock where two would be sufficient under proper conditions. A manager with ideas of efficiency finds these conditions baffling him in every direction. The native loves to use his shovel as a hen uses her feet—to scratch dirt—and there is no one to teach him to shovel well. The practice of laying iron sheets to blast the round upon, though it would greatly assist shoveling, is rarely adopted because someone forgets to lay them; they get blasted out of shape, or they are badly laid and the tremendous blast from the heavy charges displaces them and then shoots them up.

A large increase of efficiency in rock drilling is easily possible, but there is no scientific study with painstaking application of its results underground, and owing to the conditions mentioned, the men in many mines often lack the necessary tools and materials. The natives soon learn more or less the proper way to handle a rock drill, but they have no idea of system or speed in working, and during the absences of the miner from his working places much time is wasted and much loss caused by drilling holes in the wrong direction, drills becoming stuck, and other preventable accidents occur. Ignorant natives often render inoperative the safety appliances for haulage, etc., causing delay and accidents.

Such, in brief, are some of the drawbacks to efficient work under Rand conditions, and a study of the organization evolved to meet them may not be without interest in other mining centers.

Executive Organization at the Mine

The organization at a mine consists usually of board of directors with, perhaps, managing director, consulting engineer, general manager, underground manager, and possibly other sectional mine overseers, mine captains, and mine foremen or shift bosses. Also under the general manager, but in a group partly under the control of the chief mechanical and chief electrical engineer, are the mine engineer and mine electrical engineer, with sometimes an underground engineer, a compound manager with assistants, a native hospital attendant with assistants, a storekeeper and a timekeeper. The mine secretary is usually not appointed by the manager, but to a certain extent the accountants, timekeeper and storekeeper are under his supervision. Sometimes, in large mines, a business manager takes most of the work referring to the surface from the manager. The metallurgical staff is usually more under the control of the head metallurgist of the group. The exact position and authority exercised by the consulting engineer, the head office staffs and the general manager at the mine vary with the different groups. In some groups the consulting engineer is merely the technical adviser, while the managers exercise real authority and initiative. In others the control is absolutely centralized and the consulting engineer practically makes all appointments of the staff. At the central office is decided exactly what stopes shall be worked, and the manger has scarcely authority to start a drive or boxhole himself. The tendency has been for the central organizations to seize mine control to reduce initiative in the mine staffs. The actual control of labor and the organization of mine work also differ somewhat among the various groups. The system here described appears to me about the most effective I have met.

At the mine compound, which houses the native laborers, a register of all natives recruited or engaged locally is kept. In it are entered names, passport and mine number, finger prints, chiefs, tribe, addresses, particulars of contract, date of arrival, time spent in prison or hospital, and date or discharge, death or desertion. Natives are engaged for periods of so many months, a native's working month consisting of 30 shifts actually worked. This system makes for simplicity in dealing with natives and in paying them. Each native is given a book containing 30 tickets and counterfoil. These contain the number given him in the compound and have spaces for description of work, rate of pay, date, etc., and the signature of his white gang boss, who is responsible for marking his ticket after the day's work. A small extra counterfoil numbered ticket is also most useful in checking, as will be described.

Morning Labor Situation at Compound

The situation on any morning, before work, is this: In a compound, perhaps half a mile from the work, are several thousand natives. Some are due to go on night shift; the remainder comprises natives due to work who may be willing or unwilling to do so, and the problem is to collect and deliver them to their separate gangs at their working places underground. The conditions may vary from an outcrop mine, where natives walk in and out through various openings and small shafts, to a deep-level mine, where all are lowered through one or two large shafts. The compound manager has white assistants and native compound police to assist him, and natives working on the same shifts are kept so far as possible in the same rooms.

According to the first system in use, which is the best, in the early morning the compound manager lines up the shift due for work and checks them off in accordance with a list. The accuracy of the list is most important; it is made up by the clerk at the shaft and has to be revised every day, noting transfers and other changes. In the mine captain's office there is a board containing lists showing the names of all miners working, their working places and the numbers of the various natives under them. This list is best kept on a separate card for each man, on which any necessary instructions can be furnished, and a duplicate can be given to each miner. Thus a check is kept against natives' moving from gang to gang, or miners' taking more natives than they should or natives that are not allotted to them. Shift bosses alone are allowed to transfer natives and must note their numbers and give the shaft clerk all particulars of such changes. The lists are checked twice a week by examining all native tickets sent in by miners. These tickets are inclosed in the miner's own time envelope and turned in to the office at the end of the shift.

Though the compound manager may have turned out a shift, there is no guarantee that some who left his compound may not have gone off elsewhere, and here the extra numbered counterfoil is useful. At the shaft the natives are lined up and each one hands in his numbered counterfoil as he enters the cage. As soon as the shift is down, these are checked with the gang lists, and within an hour the result, showing absentees, is sent to the compound.

The compound manger then has to deal with it immediately, and punish offenders or return such information as follows: No. 1367 in prison. No. 478 herewith sent to work. No. 987 absent on leave. No. 28 deserted. No. 596 reported sick and sent to hospital. No. 1976 discharged.

In other mines all white miners are given gangbooks showing the numbers of their natives and kept up to date by the shaft clerk. The gang bosses are supposed to check their gangs at the beginning of the shift, and native miners are then sent down to collect all books and bring them to the surface to be checked as before. This, however, is a poor system, as white miners will not trouble about it. Sometimes the checking of these books is deferred till next day and the compound manager furnishes a report on all absentees as before described.

Where natives are engaged in hand drilling, they are paid so much an inch drilled and the inches drilled are marked by the miner on the day's counterfoil and on the book of tickets which the native keeps. The counterfoil reaches the timekeeper, who marks the value of the ticket and credits the native the amount; all tickets are then sorted and debited under the various items of mine expenditures. When the native has given in all his counterfoils, he knows his work is finished, turns in his book, draws his money and receives a new book. This system is simple and allows of no misunderstanding in dealing with the native miner; it also makes cost accounting easy, as different-colored books and tickets can be used for various departments of work.

By the aid of this system and the compound register, and by requiring the compound manager, the timekeeper and the secretary to attend all paydays, it is easy for the auditor to discover cases of fraud on the part of officials, such as paying out for dead natives, on tickets not presented by working natives, native forgeries, and other pretexts.

The System of Tallies

The control of actual mining work is obtained by a system of tallies, as is usual elsewhere. The cars of ore are sent to mill, with their contents weighed or estimated, are checked against shifts hoisted, and these against daily team tallies of the ore taken from the different working places. Where enough cars come to one bin, the tag system is found the best check to adopt, especially if a contract tramming system is employed with the natives. Where a large amount of development is going on, a list should be kept in the mine captain's office of each face working and each shift. Shift bosses report on it thus: C = cut blasted, R = whole round blast, NB = no blast; so that the average progress of each face can be watched and causes of delays inquired into at once. The government mining regulations compel the shift bosses to record the working conditions of their section every shift in books provided; these are usually also made into diaries in which the mine captain enters his instructions and remarks for future reference. Having lists showing the number of rock drills or hammer boys working in any face and the cars trammed from it for a day or a week, the working efficiency for any particular gang can be seen and, knowing the value of the ore, an idea can be gained whether the place is payable or not.

A tally of the total piston- and hammer-drill steel sent down and up every day, divided by the number of machine-shifts worked, enables a check to be kept on drill supply and sharpening and on the collection of drills underground, and suggests investigation of losses. The graphic method of plotting is useful in showing variations in the daily work of the mine, such as use of explosives, drills working and other helpful data. These, however, need to be interpreted by the aid of frequent underground visits by a manager who has had his underground eyes trained to see things until automatically they note details such as those mentioned, which, small in themselves, together go to spell the magic word efficiency.

Electric Activity in Ore Deposits

It is suggested by some geologists that electric phenomena might play an important part in the formation of ore deposits says a bulletin by the United States Geological Survey, and that electric methods might be utilized in prospecting for orebodies. Both these suggestions, in the light of the growing knowledge of ore deposits and of electricity, appear to be illusions. It is now clear that the great causes of ore deposition are not electric in the ordinary sense and that the electric currents generated in ore deposits are far too small to aid a prospector in discovering ore by their influence on a galvanometer or other electric apparatus held in his hands.

If, however, electricity is denied a leading part in the formation of ore deposits, its action cannot be disregarded entirely. It is well known that many chemical reactions are capable of developing measurable electric currents, and it should therefore be expected that in places where chemical action is in progress in ore deposits today electric activity should also be detectable. This has indeed been shown to be the case by several experimenters, and miniature batteries can be formed with water for the battery fluid and certain metallic minerals common in ore deposits as the poles. A report entitled "Electric Activity in Ore Deposits," by Roger C. Wells, recently issued by the United States Geological Survey, records a series of careful measurements of the electric potentials developed when various metallic minerals, common in ore deposits, are in contact with water or with solutions of various salts. Mr. Wells concludes that the character of the solutions has fully as great an influence on the electric activity developed as the nature of the metallic minerals; and that acid and oxidizing solutions generally give the highest potentials and alkaline and reducing solutions the lowest. Economic geologists have long recognized that the solutions in the upper oxidized portion of many ore deposits are acid and oxidizing, while further down they become neutral or alkaline. Whether such variations and the electric differences dependent upon them are sufficient to cause an appreciable electric current to flow from the upper part of an ore deposit to a lower part or vice versa is still an open question. Surely such action, if it exists, is of relatively minor importance in controlling ore deposition, the main factor being the actual movement of metal-bearing solutions from one place to another. Measurements of electric potential can, however, be quickly and easily made and may prove very useful in indicating the direction and intensity of the chemical reactions of which they are an expression. This subject, if investigated, may become a matter of both theoretical and practical importance.

Mineral Prospects in Fergus County, Mont.

By O. W. Freeman*

SYNOPSIS—Present mineral production chiefly from gold deposits found in limestones in the vicinity of intrusive rocks. Small amounts of lead and zinc ore have been shipped. A few thousand ounces of silver is produced annually from the cyanidation of gold ores. Copper, gypsum, coal, oil, sapphire and topaz are found in different parts of the county. One cement mill is in operation and two more are contemplated.

The metal deposits of the county are restricted to the neighborhood of intrusive igneous rocks, which usually occur only in or near the mountains. The mountains are rather detached groups and nearly surround western Fergus County, which is called the Judith Basin; they include the Judith, North Moccasin, South Moccasin, Big Snowy and the eastern part of the Little Belt Mountains. The mining industry centers at Lewistown, which is the county seat and main trading center.

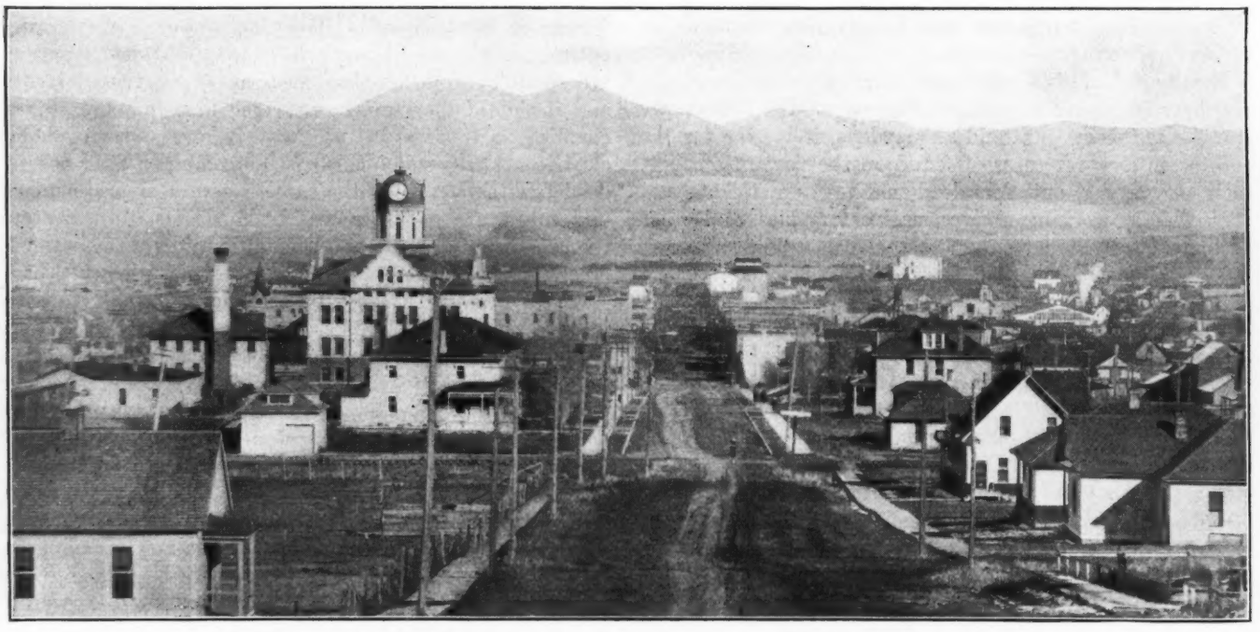
Gold is the most important of the metals produced in Fergus County. Of the total production to the end of 1916, more than half came from the Judith Mountains. Gold was first discovered in 1879 at the old town of Yogo in the Little Belt Mountains; placer gold was found in the Judiths in 1880, and the Spotted Horse and some other mines were located soon afterward. Locations were made in the North Moccasin Mountains in the 80's but the production was very small before 1900.

Placer gold has been produced from the Judith Mountains, especially in Alpine Gulch and Armell's Creek; from the Little Belts near Yogo; and from the southern gulches in the North Moccasins. Old flumes and piles of worked-over gravels and rock remain in several of these gulches to mark the activity of the placer miner, but it is doubtful if a total production was great. Only a few ounces are now reported each year.

Gold is sometimes found in small stringers in porphyry dikes in the Moccasin and Judith Mountains, but the production from them has been small, although some of them occasionally contain rich specimen ore. No important mine has been developed from such deposits in the county.

The commercially profitable gold deposits are mostly in limestone near rhyolite porphyry intrusions. Occasionally the gold has been concentrated in rich shoots and pockets, as at Maiden, but more often the deposits are low-grade, worth only a few dollars per ton. Free gold is rarely seen; much of the gold is in the form of tellurides.

The Spotted Horse mine at Maiden has been operated continuously from 1881 to the present except from 1902 to 1912. Like the near-by Maginness and Cumberland mines, it is operated under lease at present. Most of the ore produced in the Maginness and Spotted Horse mines in the past was high grade; no ore worth less than $20 paid to ship to the smelter. Small cyanide plants have been installed at these mines and ore worth only $3 per ton can now be treated at a profit. Some other properties near Maiden have produced many thousand dollars in the past, and development has been done on several prospects recently with encouraging results. Good results have come from reopening some of the old mines in recent years, and much favorable ground still remains to be prospected. The output will likely continue for many years.



LEWISTOWN, MONTANA, WITH JUDITH MOUNTAINS IN BACKGROUND

On the south side of the Judiths, near the now nearly deserted town of Giltedge, much gold has been produced from the Northern Pacific, Gold Reef, Whiskey Gulch, Mammoth and other mines. Claims were located in 1883, but the chief production was from about

*Lewistown, Mont.

1895 to 1905, since which the output has dwindled to nothing. The ores were low-grade. Two mines have recently been leased, and it is hoped that they will be reopened. Considerable time and money have been spent on properties at New Year on the north side of the Judiths and in the Cone Butte district without developing any important mines.

Claims were located in the North Moccasin Mountains in the early 80's, chiefly on small pyritic veins in porphyry, and the ruins of two small stamp mills remain to remind the present-day prospector that gold has not yet been found in paying quantities in such deposits there. On the southeast side of the mountains low-grade gold ore occurs on the contact between limestone and a porphyry dike.

In the North Moccasins considerable development work has been done on the Gold Links and Golden Discovery near the Kendall mine, and on the Abbey and other claims near the Barnes-King without discovering any extensive orebodies. Development work was done in the summer of 1916 on the West Kendall and North Kendall properties, and some low-grade gold ore was found.

The chief prospecting in the Big Snowy Mountains has been done in Cottonwood and Swimming Woman Cañons near dikes or sheets of porphyry. Encouraging signs of gold and copper have sometimes been found, but no important orebodies have been located.

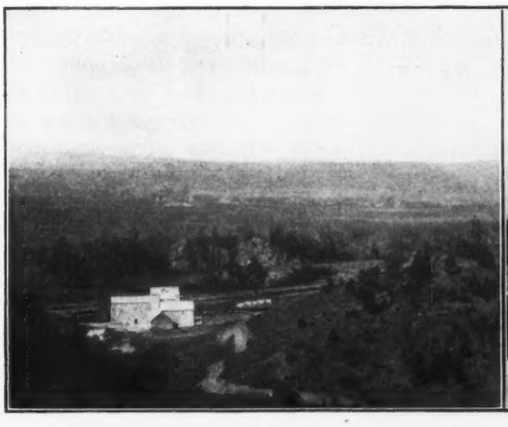
Considerable time and money have been spent in the South Moccasin Mountains in a search for gold. Claims have been staked on barren sandstone and on areas of altered porphyry; small calcite and quartz stringers have been found in sandstone that are gold-bearing, and a lead of gold ore on the contact of limestone and an intrusive rock seems promising, but there has been little production from these mountains, although in similar conditions in the near-by North Moccasions and Judiths there are profitable deposits.

Gold occurs in that part of Fergus County which includes the eastern slopes of the Little Belt Range on Running Wolf Creek and near Yogo, but the production has been only a few thousand dollars. Lead-silver ores predominate in this district. They occur as replacements in limestone near the contact with intrusive rocks. The orebodies have usually proved small and pockety. The total production has been chiefly from the Mountainside, Sir Walter Scott, Weatherwax and Woodhurst properties. Recently the Yankee Girl has been reopened and lead-zinc ore shipped to Great Falls.

Lead ores have also been found in the West Kendall mine in the North Moccasins and on claims on Cone Butte, Elk Mountain and Armell's Creek in the Judiths, and small amounts were shipped during 1916. Zinc ores have been found on the War Eagle at Maiden and a small pocket of lead-zinc ore on the Hardly Able near the South Moccasins. A few thousand ounces of silver is recovered each year along with the gold in the cyanide process.

Traces of copper have been known in different parts of Fergus County for many years, but practically nothing was done with them until the last two years. Ed Sutter and associates, of Lewistown, have four claims on the south side of Red Mountain, in the Judiths, where copper is found in veins in porphyry. A lead of 2 to 3% copper has been found, but more development is needed. During March, 1916, these men located claims on a contact metamorphic deposit on Armell's Creek, from which considerable 10 to 15% oxidized copper ore has already been shipped. Development work is in progress.

In the bottom of the creek near-by is an extensive deposit of limonite, but nothing has been done with it. In the Little Belt Mountains, on Running Wolf Creek, a large deposit of 50% hematite is found; Paris Gibson and others, from Great Falls, have 30 claims on this deposit that will soon be patented.



GYPSUM MILL NEAR LEWISTOWN

KENDALL MINE IN THE NORTH MOCASSINS

The valuable nonmetals, excepting fuels, found in Fergus County include gypsum, sandstone, sapphire, topaz, lime and materials for brick and cement. Gypsum beds are common. Beds 10 to 35 ft. thick occur along the borders of the Big Snowy and South Moccasin Mountains and on McDonald Creek divide. A mill at Hanover, 7 miles west of Lewistown, was completed about the middle of 1916 and is producing 100 tons of cement daily. Another mill will soon be built 10 miles east of Lewistown by the United States Gypsum Co.

Considerable sandstone suitable for building purposes occurs in the county along valleys where quarrying is easy, and much is used each year, chiefly the Kootenai sandstone that overlies the coal beds.

Lime was formerly made in small kilns, especially in the Judith Mountains, but none has been burnt in recent years and a modern lime-kiln near a railroad should prove a successful venture as a source of supply for operations in this part of the country.

Much material suitable for portland-cement manufacture is available, and the Three Forks Portland Cement Co. has decided to build a 1200-bbl. daily-capacity cement plant 7 miles west of Lewistown; the limestone will come from the South Moccasins by a 14,000-ft. tramway.

Brick is made at Lewistown from shale, great quantities of which occur in the county.

Gem topaz has been produced from the West Kendall mine in the Moccasins and has been cut into excellent stones resembling the diamond. It is claimed locally that this is the only place in the world where sapphires are mined profitably from the rock in which they occur. Elsewhere the production is from placers. Sapphires occur at Yogo, near Sapphire in the Little Belt Mountains. Claims on the sapphire dike were first located in 1895, although stray sapphires had previously been picked up and recovered along with gold in placers. The rock, after mining, is placed on board floors and allowed to weather. It is then washed through sluices, and the sapphires are collected in the riffles, the process being repeated several times. At the American mine a system of magnetic concentration was used. This mine was purchased about two years ago by the New Mine Sapphire Syndicate, an English company. The gem sapphires were practically all shipped abroad to Belgium for cutting, hence production has been greatly curtailed during the last two years by the war.

The county contains extensive and valuable coal deposits. At one time it was an important producer of coal, but when Musselshell County was formed, the latter took away the important coal-mining town of Roundup, since which the yearly production of Fergus County has been small. Until two years ago there were no large mines in the county; now, however, the Cottonwood Coal Co. at Lehigh, on the Great Northern R.R. in western Fergus County, has one of the best-equipped mines in Montana and is producing several hundred tons a day. The coal is almost all used by the Great Northern R.R. The surface plant includes coal-washing machinery and a long aërial tramway to remove the waste. Considerable slack is produced which might be used for fuel by the cement plant to be built near Lewistown.

The coal in the Judith Basin is a fair grade of bituminous. In northern and eastern Fergus County, thin seams of lignite, which locally thicken into lenticular beds, as at Cutbank, occur in the Judith River formation. Lignite is also found at Roundup and in eastern Montana.

Some indications of petroleum and natural gas have been found in the county. Considerable geological work was done during 1916 in a search for oil, and numerous leases have been taken; it is planned to drill in two or three parts of the county during the summer of 1917.

Denver Engineers' Census

The Engineering Group of the Denver Civic and Commercial Association is making arrangements for the listing of all engineers in order that the association shall have a complete record of the engineering personnel for use in assisting the Government in preparing for or carrying out war measures. This work is parallel with that being done in all centers.

The Denver committee, of which L. G. Carpenter is chairman, has requested a headquarters for examining engineers for admittance to the Engineer Officers' Reserve Corps at Denver. The nearest examining points have been Fort Leavenworth, Kan., or Yellowstone. It is likely that some such arrangement will be made.

United States Smelting, Refining and Mining Co.

The annual report of the United States Smelting, Refining and Mining Co. for 1916 shows the net earnings for the year, including those of its subsidiary companies, to have been $8,898,464, of which $1,702,225 was paid as a 7% dividend on the preferred stock, $1,492,239, or $4.25 per share, on the common stock, $1,000,000 carried as additional reserves for depreciation and $4,704,000 added to the undistributed surplus. Including metals from custom ores and from Mexico, the production was:

TOTAL METAL PRODUCTION

Copper	28,888,093 lb.
Lead	103,855,451 lb.
Zinc	65,584,001 lb.
Silver	11,647,205 oz.
Gold	129,273 oz.
Coal	756,931 tons

The average prices at which metals were sold during the year were: Copper, $0.27297 per lb.; lead, $0.06676 per lb.; zinc, $0.12327 per lb., and silver, $0.65386 per oz.

The tonnage of ores produced from Centennial-Eureka, Mammoth, Gold Road, Tennessee and Bingham mines, and in Mexico, was 1,022,306 tons, of which the values of the metal contents were in the proportion of 39% copper, 8% lead, 15% zinc, 28% silver and 10% gold.

A favorable opportunity presented itself to acquire at Checotah, Okla., a zinc smeltery designed for the use of gas on modern lines. This smeltery was served by a new gas field, of such an extent that the supply of gas is assured for many years. Payment for this smeltery was made partly in cash and partly by the transfer of the plant at Iola. The sum of $350,000 was written off the cost of the zinc plants, which now stand at $486,030. The entire cost of the three zinc smelteries purchased in 1915 is now written off, and an adequate depreciation of the new smeltery at Checotah has been set aside. The lease on the Ritz mine in Oklahoma on a royalty basis was obtained, and the mill from Ravenswood was moved to this property. The development shows high-grade zinc ore from which a good profit should be derived.

The operations in Mexico have been hampered by a variety of difficulties, among which has been the inability to obtain sufficient cyanide, dynamite, timber and other supplies. During the first of the year both mills in Mexico were able to operate. During the last half of the year, only one could operate, and that only part of the time. It was deemed best, however, pending anticipated improvement in conditions, to maintain the organization and to keep mines and plants in good repair and working order, as well as to carry on such development work as adverse conditions would permit. The expense of this upkeep of nonproducing capacity exceeded the profit from the very small proportion of producing capacity during the last half of the year. For the entire year the profits derived from the Mexican operations amount to only 4.7% of the total profits. Arrangements, however, have been made for obtaining sufficient quantities of cyanide to meet needs. Ample supplies of dynamite are now on hand and reasonably assured for future needs. Timber is being more readily obtained. Latest reports from Mexico are that conditions are improved.

David H. Browne

David H. Browne died at his home in Montclair, N. J., Mar. 30, 1917, as a result of complications following grippe. The end came suddenly, when both Mr. Browne and his family were expecting a speedy recovery and planning a trip to Jamaica for complete recuperation.

In the *Bulletin* of Canadian Mining Institute for March, 1917, was an interesting biography of Dr. Browne under the caption "Institute Notabilities," which is reproduced here. This was written in a lighter, happier vein than could be done now he has been taken away. The prophecy contained that he would some time write the story of his success can now never be fulfilled.

"It falls to the lot of few men in any walk of life and to those engaged in purely scientific pursuits in particular, to be so widely known and so universally respected as the subject of this sketch. David H. Browne, metallurgist, author and speaker, was born June 8, 1864, at Hollymount, in the County of Mayo, Ireland. He passed successfully through the ordeal of the famous academy at Londonderry, and at the age of 16 came to America, and continuing his scholastic career, graduated with the class of 1885 at the University of Michigan. Then followed a brief period of apprenticeship and training, first as chemist with the Joliet Steel Co., under Emmerton, then in a similar capacity at the Ludington mine, Iron Mountain, Mich., and then back to the academic atmosphere of his alma mater as instructor in inorganic analysis, 1888-9. There is no doubt that had he remained he would have been today a popular and successful professor, but luckily for the mining profession, the young Irish lad found the university life too tame, and, as he said himself, he couldn't stand the job, had to hear steam blow off and see the wheels go round, so worked till 1891 at the Andrews and Hitchcock blast furnaces, Hubbard, Ohio.

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DAVID H. BROWNE

"In 1891 he entered the service of the newly organized Canadian Copper Co. as chemist, and since then his whole time has been devoted to the working out of the complex metallurgical problems constantly occurring and persistently recurring in connection with the nickel-copper ores of the Sudbury field.

"Suffice it to say in this short sketch that he made a success of the job. It also goes without saying that in the 26 years of continuous service with this company he has not lacked for excitement and material for study. To his heart's content he has heard steam blowing off, sometimes accompanied by and closely associated with nickel-copper matter which should have been quietly simmering in the settler. He has seen wheels in countless numbers go round at varying speeds, has even been known to whisper to the engineer that it was revolutions he wanted, not pressure. Some day Browne himself will write in his own inimitable way the history of the Canadian Copper Co., and inseparably woven into it will be the story of his own struggles and experiments, his failures and ultimate success.

"In 1889 he greatly improved his chances of success by marrying Sara M. Davis, daughter of Captain Davis, then in charge of the company's mining operations. This, he himself asserts, was the best thing he ever did. Brown is a veritable encyclopedia of furnace records, historical dates, chemical equations and reactions, ores and minerals with particular reference to their behavior when mixed with other substances in a modern furnace, and the whole mass blown to unrecordable temperatures. What he does not carry in his head, he has carefully recorded in handly little notebooks closely written in indelible ink. These he produces on rare occasions; for instance, to carefully record in a line or two, information that kept some poor unfortunate clerk, "who knew not David," delving and digging through old musty furnace records for a week. The information so diligently sought and more carefully recorded would, in all probability, be the amount and metallic contents of the matte produced by some particular furnace for the last 17 days of November, 1886.

"He could tell bessemer matte from converter slag at two chain lengths; he could also tell the foreman of the loading gang what he thought of that official's ability or inability to distinguish them.

"If the reader thinks that Browne was all chemistry and that his thoughts and reasoning were confined to water-jacketed areas, ask the young Brownes who was the author and illustrator of the charming story books they read when they were kiddies.

"On the job he was noted for his kindness to the young men who worked under him. Now he is metallurgist emeritus with many years of usefulness ahead, and one of the happiest, fullest lives in the world to look back upon. We have said that he was metallurgist, author and

most delightful and entertaining of speakers. We should have added preacher—a preacher of the gospel of human kindness, of helpfulness to the young students of science, aider and abettor of every movement which has for its object the social betterment of the working class. Honors, well deserved, are coming fairly fast. At the annual convocation of Queen's University, Kingston, in April, 1916, he had conferred upon him the degree of Doctor of Laws in recognition of his work for the advancement of scientific knowledge. He is now known as Dr. David H. Browne, but the added title has proved no impediment. He is still plain Dave to his friends, and his greatest work lies before him."

To the foregoing appreciation of our good friend, Dr. David H. Browne, little need be added, says the editor of *Bulletin*. It is an admirable summing up of the characteristics and qualities of one who is universally esteemed and respected by reason not only of the position he has attained in the front rank of the metallurgists of the continent, but also because of his personality—his disinterested kindness and warm-heartedness, his altruism, and in general his broad and generous outlook on and attitude toward life. As he himself remarked in his fine tribute to Prof. Robert H. Richards, another lovable nature: "The greatest thing in life is personality. The greatest men are those whose fingers find the chords of life and at whose touch we thrill in sympathy." And realizing this truth, few will challenge Dr. Browne's right to a position of honor and eminence among his fellows. To the Canadian Mining Institute, of which he has been a member for 12 years, he has been always a loyal and helpful friend in need and deed.

Dr. Browne was a no less valued and beloved member of the Mining and Metallurgical Society of America and the American Institute of Mining Engineers, in which he held several important chairmanships and was the moving spirit of the executive committees. He leaves a wife and three sons.

Engineers' Volunteer Regiment

Steps were taken on Apr. 3, at a meeting of prominent engineers in the Engineering Societies Building, 29 West 39th St., to organize the First Volunteer-Engineer Regiment. Col. C. H. McKinstry, a West Point graduate and for more than 20 years engaged in engineering work for the army, was designated as colonel of the new regiment, and Major William Barclay Parsons of the United States Officers' Reserve Corps, and Major Arthur S. Dwight were designated as majors.

J. Waldo Smith, chief engineer of the Department of Water Supply, Gas and Electricity of New York, is chairman of the committee which is undertaking the formation of the new regiment, and the secretary is J. S. Langthorn, deputy commissioner of the same department, Robert Ridgway, chief engineer of construction of the Public Service Commission, is chairman of the recruiting committee, which will open this week an office in the Engineering Societies Building.

It is expected the ranks of the new regiment will be filled within two weeks because of the attractive features connected with army-engineering work. The pay of the engineering corps is the highest in the army; there are more officers in proportion to enlisted men and promotion is more rapid. The ranks will be made up of topographical and mechanical draftsmen, photographers and blueprint men, quarrymen skilled in explosives, miners, carpenters, bridge carpenters, blacksmiths, plumbers and pipe fitters, electricians, gas- and steam-engine men, machinists, masons, calkers, riggers, expert axemen, boatmen and horseshoers.

Chronology of Mining, March, 1916

Mar. 1—Star Mining Co. filed suit for $500,000 against Federal Mining and Smelting Co. for alleged ore trespass from latter's Morning mine in the Cœur d'Alene district, Idaho—Increase of 25c. per day in wages made by Park City, Utah, mines as a result of the high prices for lead and silver—In the Cœur d'Alene district of Idaho, another increase of 25c. per day was made effective, while lead remains at or above 7½c. per lb., total bonus now being $1.25 per shift.

Mar. 6—Price of lead in New York touched 9¾c. per lb., being the highest price since Civil War times—Hollinger Consolidated, in the Porcupine gold district, cut its dividend from 1% in four weeks to 1% in eight weeks, until mine work can catch up to requirements of the consolidated company.

Mar. 8—E. P. Mathewson awarded 1917 medal of Mining and Metallurgical Society of America, for distinguished service to the industry.

Mar. 12—First train of ore hauled from Goodwin, terminus of new Deep Creek railroad in western Utah.

Mar. 13—Capitalization of Copper Queen Consolidated Mining Co., of Bisbee, Ariz., increased from $2,000,000 to $50,000,000 to become the sole operating company for the Phelps Dodge Corporation, the successor of Phelps, Dodge & Co.

Mar. 14—Termination of extension period for forfeiture of Mexican mining properties which are not operating or which have failed to request exemption because of impossible operating conditions.

Mar. 15—Old Dominion Co. of Maine succeeded Old Dominion Copper Mining and Smelting Co., a New Jersey corporation, and will henceforth operate the Old Dominion and the United Globe mines at Globe, Ariz.

Mar. 16—Tamarack shareholders voted to sell their holdings at $60 per share to Calumet & Hecla Mining Co., thus giving latter complete control of this old Michigan copper mine.

Mar. 17—Eden Mining Co., Tonopah Mining Co. subsidiary in Nicaragua, began milling its gold ore at initial capacity of 150 tons daily—First ore from 2700-ft. level on Comstock Lode, Nevada, mined during this week from old Consolidated Virginia mine; lowest mining in "bonanza days" was on 2500 level.

Mar. 21—Leading U. S. copper mines offered Government about 45,000,000 lb. of copper at 16⅔c., average price supposed to have been received by U. M. S. Co. during last decade, instead of current price of 30½@32c. per lb.

Mar. 22—End of two weeks' strike at Nichols Copper Co. refinery at Laurel Hill, Long Island.

Mar. 24—Fire in Utah-Apex mine at Bingham, Utah, beginning on 1000-ft. level, extended to 1300-ft. level, and flooding was resorted to on Mar. 28.

Mar. 30—Semicentennial of Alaska purchase for $7,200,000—Death of David H. Browne, metallurgical engineer for International Nickel Co. and chairman of New York Section of American Institute of Mining Engineers.

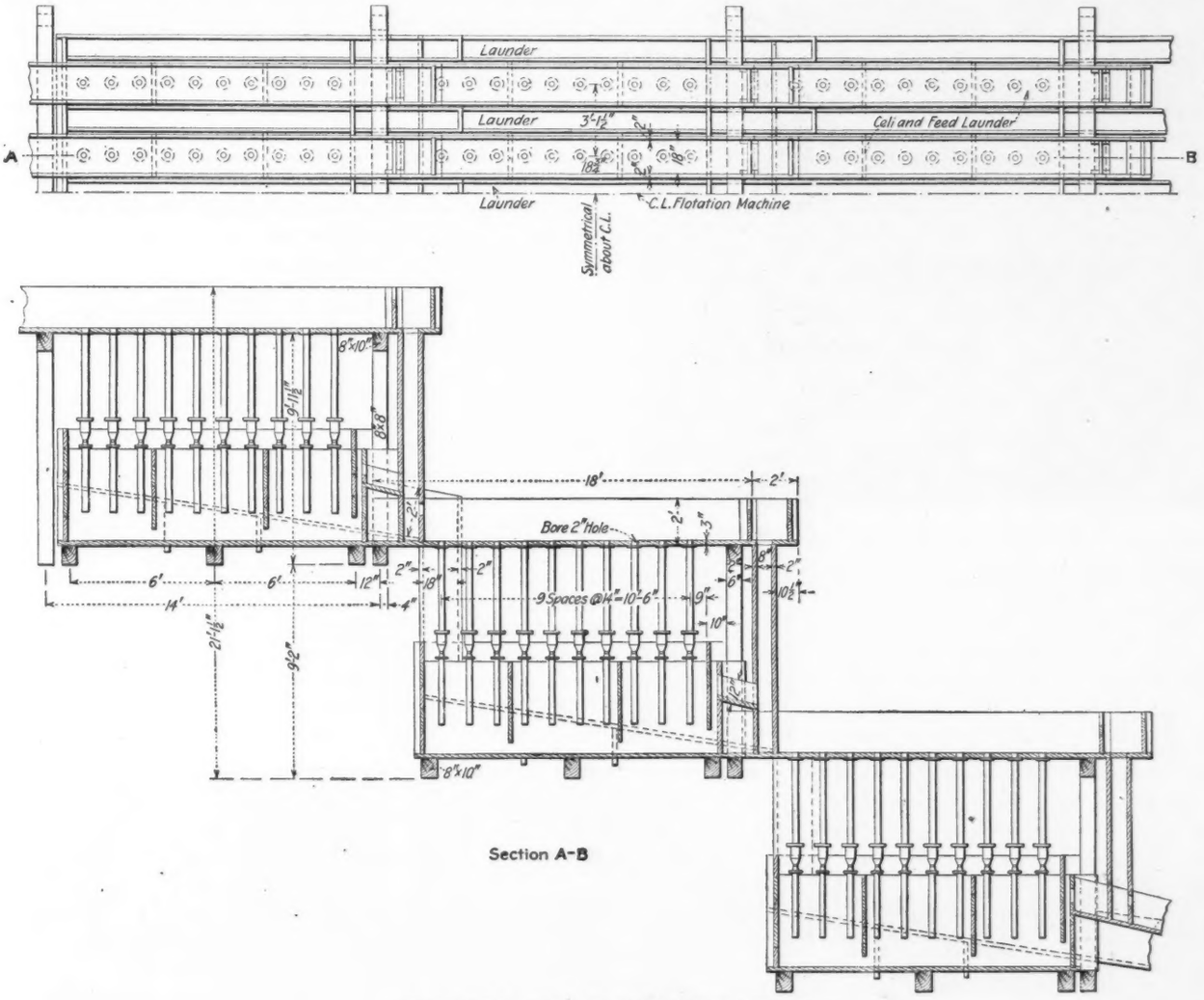
Hydraulic Flotation Machine

By Arthur Crowfoot*

The description given here is of a form of flotation machine that is in operation at the mills of The Arizona Copper Co., Ltd., at Morenci and Clifton, Ariz. The machine is of interest for several reasons, among which may be mentioned the following: The aëration of the pulp is accomplished automatically by its gravity fall; there are no moving parts; no porous medium is used; the machine requires little attention and no power.

During the period from May, 1915, to September, 1915, inclusive, three different forms of air-entraining machines were developed and put into successful operation on slimes tailings, and from the experience gained in the operation of them a final form of machine was decided upon.

The first experimental machine was constructed to entrain air by passing the pulp through a long, narrow slot in the bottom of a launder, the slot being contained between tight sides which extended about one foot below the water level in a frothing tank. The frothing tank was



THE HYDRAULIC FLOTATION MACHINE

A brief history of the machine shows that during the month of March, 1915, K. H. Donaldson, foreman of No. 4 concentrator, of Clifton, while considering means for simplifying the flotation apparatus in use at that time, thought of applying the principle of the hydraulic air compressor to a flotation apparatus. A few preliminary experiments demonstrated that sufficient air could be entrained or injected by a falling stream of pulp to generate a froth when the stream discharged through a nozzle or similar form of opening into a tank. In April, 1915, an experimental machine of commercial size was built at the No. 6 concentrator, at Morenci.

placed about 4 ft. below the level of the launder. The air was entrained through ¼-in. vertical pipes spaced at about 2 in. along the slot. Another system was by discharging the pulp under 4-ft. head through a large number of small nozzles into a slot just above water level in the frothing tank, or, a third system, by discharging the pulp through a smaller number of larger nozzles than in the preceding method.

These experimental machines indicated the commercial possibilities of the type, since in less than two months they produced 23 dry tons of concentrates which contained 7000 lb. of copper, this representing material recovered from the tailrace without the addition of oil, except for a short period at the start of the tests.

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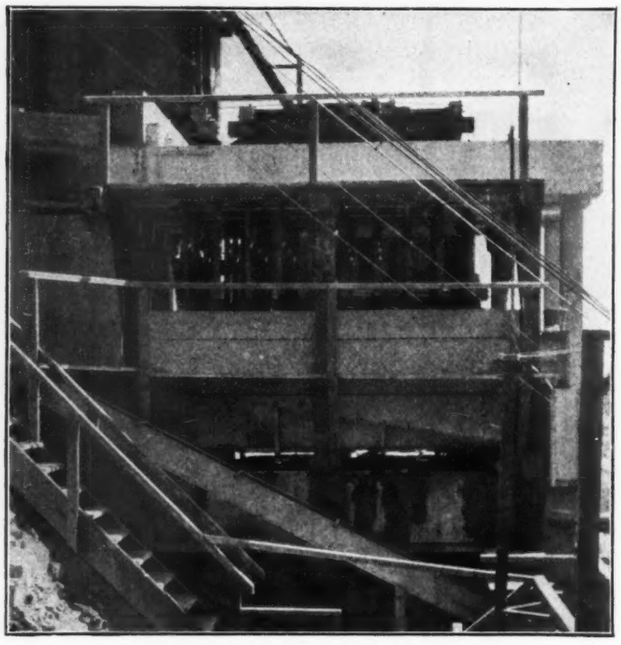
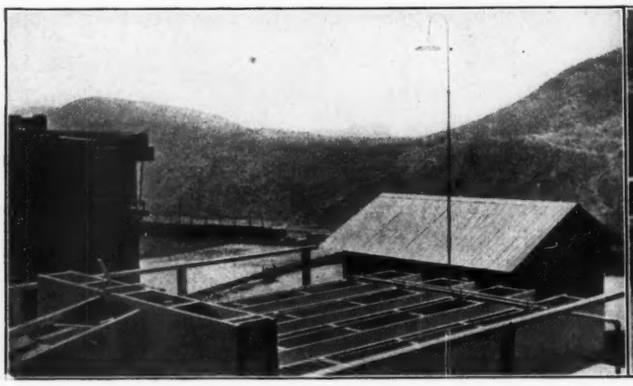
The mill was not equipped with flotation apparatus at this time with the exception of experimental units and, as a large amount of the mill water is re-used, it was not desirable to add more oil which, on its return to the mill in the reclaimed water, might cause float mineral (that otherwise might be recovered) to be carried off in the tailings. The experiments were interrupted in September, 1915, by labor troubles, which continued until February, 1916.

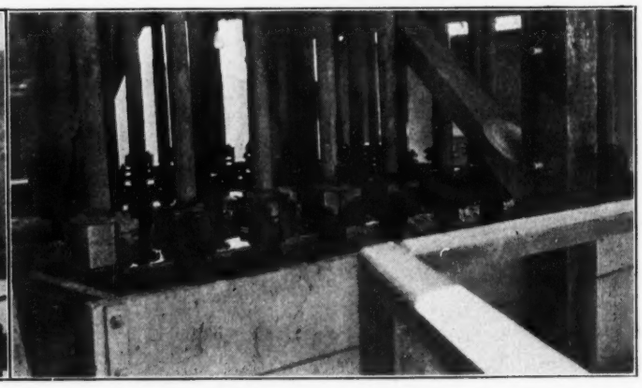


SIDE VIEW OF THE MIDDLE UNIT

The machine as developed at present, which has been named the A. C. flotation machine No. 1, is illustrated in the accompanying drawing and photographs. It consists of three units operating in series, each unit consisting of four self-aërating flotation cells. The tailings from the first unit are retreated in the second and the tailings from the second unit, in the third. The machine shown in operation in the photograph is the middle unit; the third unit is shown in course of construction. The head unit will be installed last, since before it can be installed it will be necessary to elevate the tailings launder feeding the machines to secure the necessary headroom, an essential with this kind of machine.



FEED LAUNDERS ABOVE THE FLOTATION MACHINE



FEED PIPES, SHOWING WOOD BLOCKS AS TEMPORARY NOZZLE CASINGS

Up to the present time the machine has been used only for the re-treatment of tailings, as the tailrace was the most convenient place to make the tests; but the results obtained from the unit shown in the photographs indicate the possibility of its use for the direct treatment of the slimes and fine sands. It is at present producing concentrates assaying 11% copper, and recovering 1800 lb. of copper per 24 hr. without the addition of oil, the necessary amount being supplied from the flotation tailings from the mill.

The main requisite for the successful operation of the machine is plenty of headroom; less headroom, however, than is shown in the drawing can be successfully used, but for the machine described the location of three sets of concrete piers, which had formerly supported three sand bins, furnished convenient foundations for the plant. By passing the feed to the machine through a screened tank using a $\frac{3}{4}$-in. round-hole plate screen, the machine operates without attendance, once the proper adjustment of the tailboard, which controls the water level in the frothing tank, is decided upon.

Treating Low-Grade Lead Ores

At the Salt Lake City Experiment Station of the Bureau of Mines, A. E. Wells, metallurgist in charge, reported as follows to the Washington office of the bureau:

The most successful results of the metallurgical-research branch during the month were with low-grade lead ores that have failed to yield to flotation or leaching processes. By mixing these ores with sodium chloride and heating to temperatures of about 800° C., high extractions of the lead can be obtained irrespective of the kind of gangue of the ores. The lead volatilizes as a chloride, and any silver or gold present is likewise volatilized. These chlorides are precipitated from the fume by the use of the Cottrell precipitator. The precipitated lead chloride, after mixture with lime and a small amount of reducing agent, is heated to redness, when a slag of calcium chloride and metallic lead is formed. The calcium chloride is an advantageous substitute for sodium chloride in the first operation, and from 50 to 75% of the chlorine is recovered in this manner. This process will have the advantage of producing bullion from either oxide or sulphide ores in localities that do not contain sufficient water for milling purposes. Cost calculations indicate the possibility of this process being cheaper than water concentration followed by smelting.

Ray Consolidated Copper Co.

The annual report of the Ray Consolidated Copper Co., Ray, Ariz., says that the net copper production for 1916 was 74,983,540 lb., as compared with 60,338,936 lb. for 1915. This increase of 24.27% in net copper production resulted from an increase of 17.6% in the total tonnage of ore treated, with improved operations, and was made from ore carrying an average of 1.32 lb. less copper per ton than in 1915.

The cost of 10.267c. per lb. copper produced for the year was high. A careful calculation indicates that at normal wages based upon average copper-metal prices, and at former material prices, the cost for the year would have been 8.954c. per lb.

The net profit for the year available for dividends amounted to $12,084,166, or $7.66 per share. Of this $4,337,955, or $2.75 per share, was distributed to stockholders in dividends; $367,738, or 23c. per share, was applied as a reserve for depreciation; and $7,378,473, or $4.68 per share, was added to earned surplus.

There has been developed a total of 106,667,080 tons, and there has been extracted and treated 13,293,854 tons. Development, construction and equipment totaled $13,800,514. Of this amount $6,908,448 came from the sale of capital securities, and $6,892,066 came from earnings.

In ten years (of which less than six have been productive years) the company has earned a total of $25,501,974. Of this amount $1,529,946 has been reserved for extinguishment of mine-development costs and $1,227,750 for depreciation of mine and equipment, leaving a balance of $22,744,278.

Total dividends of $8,931,100 have been paid to stockholders, and the balance of $13,813,178 remains to earned surplus. This earned surplus is now represented by $4,134,369 still invested in development, construction and equipment, and by $9,678,809 represented by net current assets consisting chiefly of metals in transit and of accounts receivable.

Underground Development

The underground development for the year 1916 consisted of 66,863 ft., an increase of 21,571 ft. as compared to that of the previous year. The total development since the beginning of operations to the end of the year 1916 is 564,388 ft., or approximately 107 miles of which mining operations have destroyed to date 283,767 ft., leaving still intact 280,621 ft., or approximately 53 miles.

Through information gained from development during 1916, it was deemed advisable to recalculate ore reserves. The revised calculations of tonnage and grade are based in part upon churn-drill development, and in part upon the records of underground work. This estimate shows ore reserves remaining at the end of the year 1916 amounting to 93,373,226 tons, averaging 2.03% copper. Since the beginning of operations there has been mined a total of 13,293,854 tons, averaging 1.70% copper. Adding this to the reserves now existing, brings the total tonnage of available and profitable ore disclosed and proven in the property since the beginning of its development to 106,667,080 tons. The total tonnage previously estimated as developed in the property and as stated in the annual report for the year 1912 was 82,904,368 tons, having an average grade of 2.19%. As previously stated, the total tonnage developed from the beginning of operations to the end of 1916, as shown by revised estimates, was 106,667,080 tons. Using the previously reported total tonnage and grade as against the tonnage and grade now reported, the average value of the added reserves is calculated at 1.30%. The revised estimates do not take into account considerable areas of deep ore known to exist as downward extensions of excellent grade orebodies already proven. This ore lies deeper than the bottoms of existing drill holes where mining operations have destroyed the upper parts of many of the holes so that they cannot now be deepened, and the orebodies referred to can therefore be best developed by usual underground methods.

The total amount of ore mined from all sources during the year and shipped to the reduction works at Hayden was 3,363,466 tons, an average of 9190 tons per day, containing 1.63% copper. For the year 1915 the total production was 2,863,517 tons, or an average of 7845 tons per day. Of the ore received at the mills for 1916, 32,235 tons, averaging 4.147% copper, was sorted or selected ore which was diverted to the smelter for direct smelting. The remainder, amounting to 3,331,231 tons, averaging 1.607% copper, was milling ore.

The slight decrease in copper contents of the ore mined during the year as compared to the previous year was caused largely by the rapid drawing of the last ore in some large medium-grade reserve blocks. This was necessary in order to maintain, and, in fact, increase tonnage, and was due in great measure to the enforced curtailment of production and almost complete suspension of development and stope preparation for nearly a year beginning with August, 1914. It has been repeatedly stated in previous reports that the areas and zones in which the principal mining operations have been conducted in the past are shown by development records to be of considerably lower grade than the average for the entire deposit. The reserve blocks which were drawn upon so heavily during the year were in these lower-grade areas.

The mining costs for the year were 80.073c. per ton, of which 5.146c. per ton was due to coarse-crushing and loading, leaving the net mining cost 74.927c. per ton.

The high-grade orebody developed through and adjacent to the No. 3 shaft is, as has been frequently stated, of a character not adapted to the application of the regular system of mining used. The so-called square-set system is applied here, requiring heavy timbers and close filling. As a result of this the per ton cost of mining this orebody is approximately four times as great as that of mining the larger bodies of average grade. These high costs are included in the average mining costs stated. If the tonnage produced from the No. 3 shaft and the cost of producing it were eliminated from the general figures, the average mining cost for the year, excluding coarse-crushing and loading costs, would become 69.12c. The higher mining costs for the year 1916 are entirely due to an increase of about 30% in the cost of labor and supplies.

During the year there was milled at the Hayden plant 3,332,340 dry tons, corresponding to a daily average of 9105 tons, as compared with 7805 tons during 1915. This average was reduced somewhat on account of the lost time

during the first quarter, when operations were suspended for 11 days on account of washouts on the Arizona Eastern R.R., and the average of the fourth quarter, which was 9475 tons per day, is more nearly what may be expected until further increases of milling capacity now under way are completed. The total tonnage of ore milled since the beginning of operations and to the end of 1916, was 13,221,700 tons, averaging 1.69% copper. The average grade of the ore milled for 1916 was 1.607% copper, and the average recovery for the year was 70.20% of the entire copper contents, equivalent to 22.56 lb. of copper per ton, as compared with 64.11% or 21.45 lb. of copper per ton for the previous year. This increase in recovery is the direct result of additions and improvements in mill equipment made during the year. The concentrate production for the year was 188,778 tons, containing an average of 19.914% copper.

INCREASING EXTRACTION RESULTS

	Percentage Recovery Entire Copper Contents	Lb. of Copper Recovered per Ton of Ore	Grade of Concentrates
First quarter	64.93	21.18	17.48
Second quarter	68.33	21.57	19.21
Third quarter	71.42	22.44	20.89
Fourth quarter	75.32	24.84	21.93

The cost of milling for the year was 55.35c. per ton, as compared with 50.86c. for the previous year. The increase in milling cost is largely due to the same factors that affected mining costs in a similar way.

The tonnage treated and the production of copper contained in the concentrates, by quarters, as compared with the previous year, were as follows:

COPPER PRODUCTION BY QUARTERS

	1916		1915	
	Tons Milled	Lb. Copper	Tons Milled	Lb. Copper
First quarter	745,940	15,801,568	656,652	14,463,213
Second quarter	865,300	18,667,664	679,004	14,524,380
Third quarter	849,400	19,061,727	716,211	14,931,388
Fourth quarter	871,700	21,651,956	797,102	17,195,533
Total for year	3,332,340	75,182,915	2,848,969	61,114,514

In addition to the copper in concentrates, there was contained in ores shipped direct to the smelter, a total of 2,673,798 lb., making the gross production of copper from all sources 77,856,713 lb. The average cost per pound of net copper produced from milling ores, after making allowances for smelting and refining deductions and crediting dividends from the Ray & Gila Valley R.R. and other miscellaneous income as a reduction of operation costs, was 10.134c. The combined cost per pound of net copper produced from milling ore and direct shipping ore for the year was 10.267c., as compared with 9.423c. for the previous year. These costs include all operating and general charges, except Federal income tax as well as 12½c. per ton of ore milled, which is applied to the retirement of mine-development costs.

Ontario Mining Taxes Increased

Taxes on every mine in Toronto, the annual profits of which exceed $10,000, are to be raised from 3 to 5% yearly upon the annual profits in excess of $10,000 and up to $5,000,000, according to a recent press report from Toronto. On all annual profits over $5,000,000 and up to $10,000,000 the tax will be 6%; on all annual profits over $10,000,000 and up to $15,000 the anual tax will be 7%, and on the annual profits in excess of $15,000,000 a percentage increasing with each additional $5,000,000 in the same proportion as in the case of the second and third five millions of dollars. On nickel and nickel copper mines the new taxation is effective as from Jan. 1, 1915.

These are the outstanding features of the "nickel legislation" introduced in the Legislative Assembly by Hon. G. Howard Ferguson.

Up to the present the International Nickel Co. has paid an annual tax of $40,000 to the Province. Under the new system of taxation, it is roughly estimated that it will have to pay $1,000,000 a year, as the annual net profits of the corporation are said to be about $16,000,000.

Report of Copper Production

This table is compiled from reports received from the respective companies (except in the cases noted by asterisk as estimated), together with the reports of the United States Department of Commerce as to imported material, and in the main represents the crude-copper content of blister copper, in pounds.

	January	February	March
Alaska shipments	2,516,372	.....	.....
Arizona:			
Arizona Copper	4,100,000	4,600,000	.....
Inspiration	11,600,000	10,250,000	11,100,000
Miami	5,020,370	4,210,780	5,217,900
Old Dominion	3,000,000	2,695,000	3,335,000
Ray	7,767,663	7,177,898	.....
Shannon	759,000	888,000	950,000
Other Arizona	30,196,785	35,174,605	.....
California:			
Mammoth	2,200,000	2,200,000	2,000,000
Michigan:			
Calumet & Hecla	14,103,126	13,162,007	.....
Other Lake Superior*	9,500,000	9,000,000	.....
Montana:			
Anaconda	28,250,000	25,000,000	31,300,000
East Butte	1,479,520	1,460,440	1,597,340
Nevada:			
Mason Valley	†	†	.....
Nevada Cons	6,279,432	5,708,214	.....
New Mexico:			
Chino	6,452,154	6,572,106	.....
Utah:			
Utah Copper	13,913,811	13,459,829	.....
Eastern smelters*	2,670,370	2,039,390	.....
Total reported	149,808,603	.....	.....
Others, estimated	24,850,000	25,150,000	.....
Total United States	174,658,603		
Imports in ore	12,916,700	.....	.....
Imports in blister and refined copper	45,708,518	.....	.....
Grand total	233,283,821	.....	.....
British Columbia:			
B. C. Copper	331,667	314,274	.....
Granby Cons	2,946,476	2,580,288	.....
Mexico:			
Boleo	1,983,080	1,598,240	.....
Cananea	5,700,000	5,100,000	5,500,000
Other Foreign:			
Braden	4,798,000	3,450,000	5,942,000
Cerro de Pasco	6,172,000	5,352,000	6,074,000
Chile	7,756,000	6,056,000	8,714,000
Cape Copper	398,720	329,280	.....
Kyshtim	1,131,200	.....	.....
Katanga	3,297,280	5,152,000	.....

*Estimated. †Operation started in February.

The grand total, which in the case of January was 233,283,821 lb., includes, under "Imports in ore and blister copper" the production of such companies as British Columbia, Granby, Cananea, Braden, Cerro de Pasco and Chile. As a matter of record, however, the figures of the latter are given after the total. We also report the production of the Boleo, Cape Copper, Kyshtim and Katanga companies, whose copper does not come to the United States.

The item "Alaska shipments" gives the official figures of the United States Department of Commerce and is supposed to include Kennecott, which is not reported separately. In some months all of the Kennecott production apparently is not shipped; for example, in January, the company's production was 7,800,000 lb., whereas Alaska shipments are reported as 2,516,372. Of course the difference will appear in later reports.

Correspondence and Discussion

Air Lift for Slime Pulp

In the illustration of an air lift for slime pulp, appearing in the *Journal* of Mar. 10, 1917, the thread on the lift pipe at its juncture with the reducer leading to the air pipe should have been shown as about 5 in. long. In erecting the lift, the reducer is screwed on the lift pipe, sufficient thread appearing inside the reducer to take the sleeve. The lower lengths of lift pipe are then screwed in place, and the 5-in. air pipe connected with the reducer. The lift pipe should be kept central in the air pipe with three wedges or by means of a spacing "spider" attached to the lift pipe at its lower end.

New York, Mar. 12, 1917. A. W. ALLEN.

The Cottrell Process

In the *Journal* of Feb. 17, there appears a note on the Cottrell Process. Dr. Cottrell invented and developed two separate and distinct processes. The first of these is the well-known Cottrell process for the separation of suspended particles from gases by electric means. In this process the gases carrying the suspended particles are passed through a special apparatus in which the suspended particles are subjected to an intense electric field in which a corona discharge is taking place. Here the individual particles become charged and are then caused to migrate in the electric field, out of the current of advancing gases, and deposited upon the electrodes.

The second process deals with the dehydration of oils. This process was aimed directly at the treatment of petroleum emulsions. In this process the water-carrying oil is subjected to the stresses of an alternating electric field, which induces electric charges upon the water particles. The water particles, under the action of the electric field, coalesce to form larger globules, which readily settle out of the oil. This process has not been applied to the removal of oil from condenser water, as in this case the water becomes the suspending medium, and this water would form a short-circuit between the electrodes.

The ordinary properties of collodial suspensions play no direct part in the operation of either process, entire action being established by the electric charges placed upon the suspended particles, by subjecting the particles, together with the suspending medium, to intense electric stresses. The following articles describe the Cottrell processes for separation of suspended particles from gases: *Journal of Industrial and Engineering Chemistry*, Vol. 3, p. 542, Aug. 1911—F. G. Cottrell.

Report, Smithsonian Institution for 1913, p, 653—F. G. Cottrell; *American Institute Chemical Engineers*, Vol. 8, Aug. 1915—Walter A. Schmidt; *Engineering and Mining Journal*, Vol. 101, p. 385, Feb. 26, 1916—F. G. Cottrell.

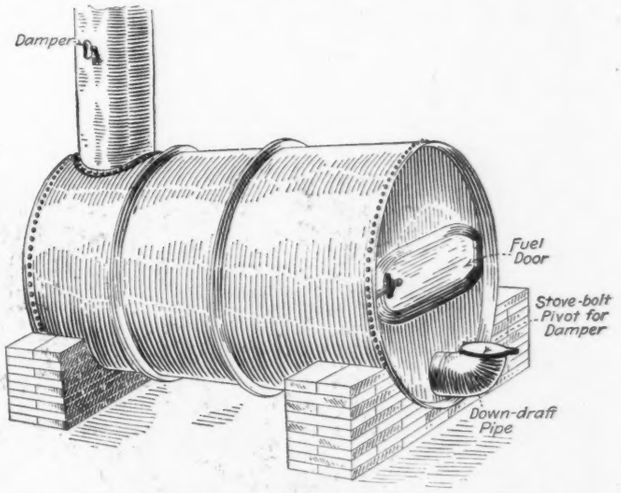
The articles given in the first two references, also touch upon the processes for dehydration of oil. This process is described at greater length in "Electrical Process for Dehydration of Crude Petroleum," by Arthur T. Beazley; in *Oil Age* (Los Angeles), Apr. 21, 1911, and also in the following United States patents: 987,114, Mar. 21, 1911; 987,115, Mar. 21, 1911; 987,116, Mar. 21, 1911; 987,117, Mar. 21, 1911.

WALTER A. SCHMIDT.

Los Angeles, Calif., Mar. 5, 1917.

An Emergency Oil-Drum Stove

In the *Journal* of Jan. 13, 1917, there was a description of an emergency oil-drum stove. I have found the Alaskan oil-drum stove an improvement upon this and have adopted it in preference to any stove on the market for heating mills or other buildings in which a large stove is needed. It requires no grate bars; there is no danger of hot ashes falling out; it is much easier to construct than the type mentioned above, and is air-tight. By closing both dampers the wood will smolder and retain fire for eight hours. The stove pipe should be 6 to 8 in. diameter and should contain a good damper. The down-draft, for air, should be not more than one inch smaller diameter than the stove pipe and should be closed by a



THE ALASKAN TYPE OF OIL-DRUM STOVE

sliding damper, consisting simply of a piece of heavy sheet iron pivoted on one side and having an ear, or lug, on the opposite side, by which it can be opened or closed.

The only thing to be careful about is to have the fuel door large enough to take all kinds of odd chunks and to have it close tight. A door 14 x 18 in. is often used, but I believe 18 x 24 in. would be better. It should be placed as far upon the side of the drum as possible so as to give plenty of room for a bed of fire. The ashes are shoveled out through this door whenever necessary.

For a foundation a couple of cradles may be built of bricks or dry-rock wall or concrete, depending on which is the most handy.

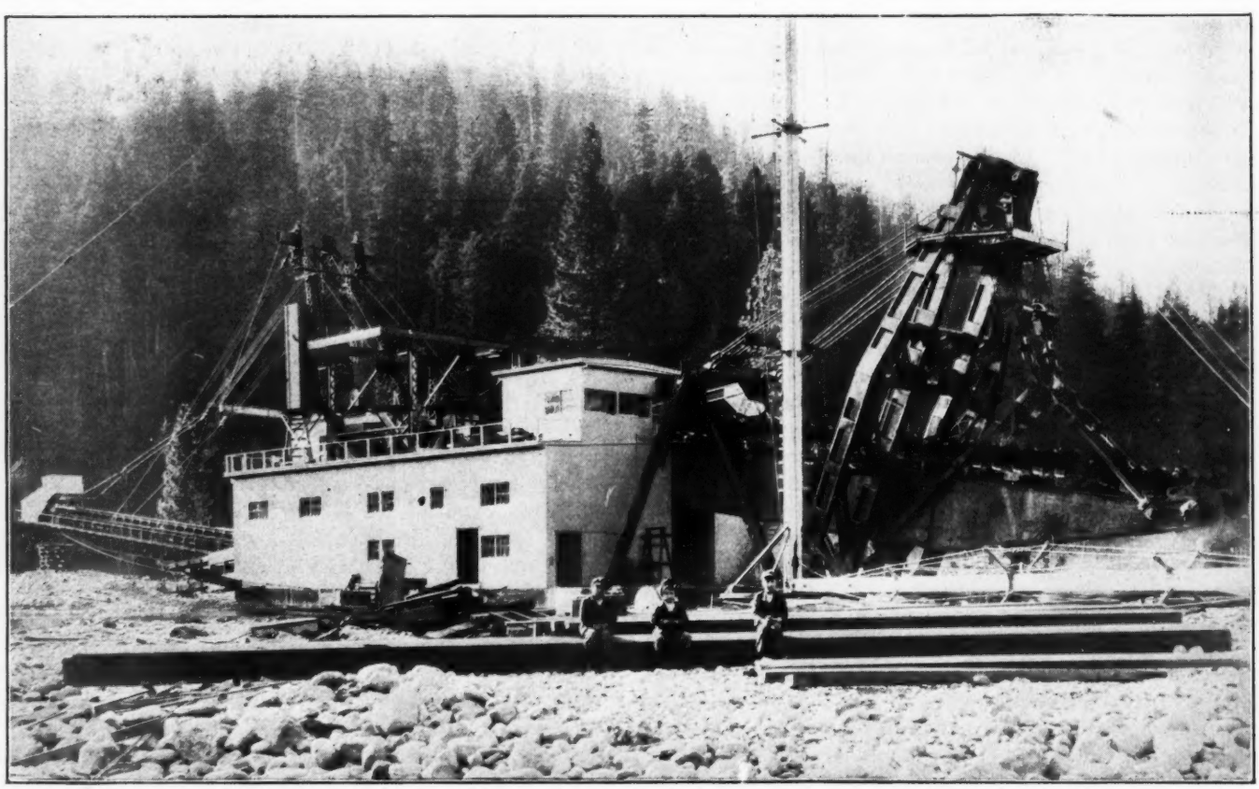
Cordova Mines Ltd., S. H. BROCKUNIER.

Cordova Mines, Ont., Feb. 19, 1917.

Photographs from the Field

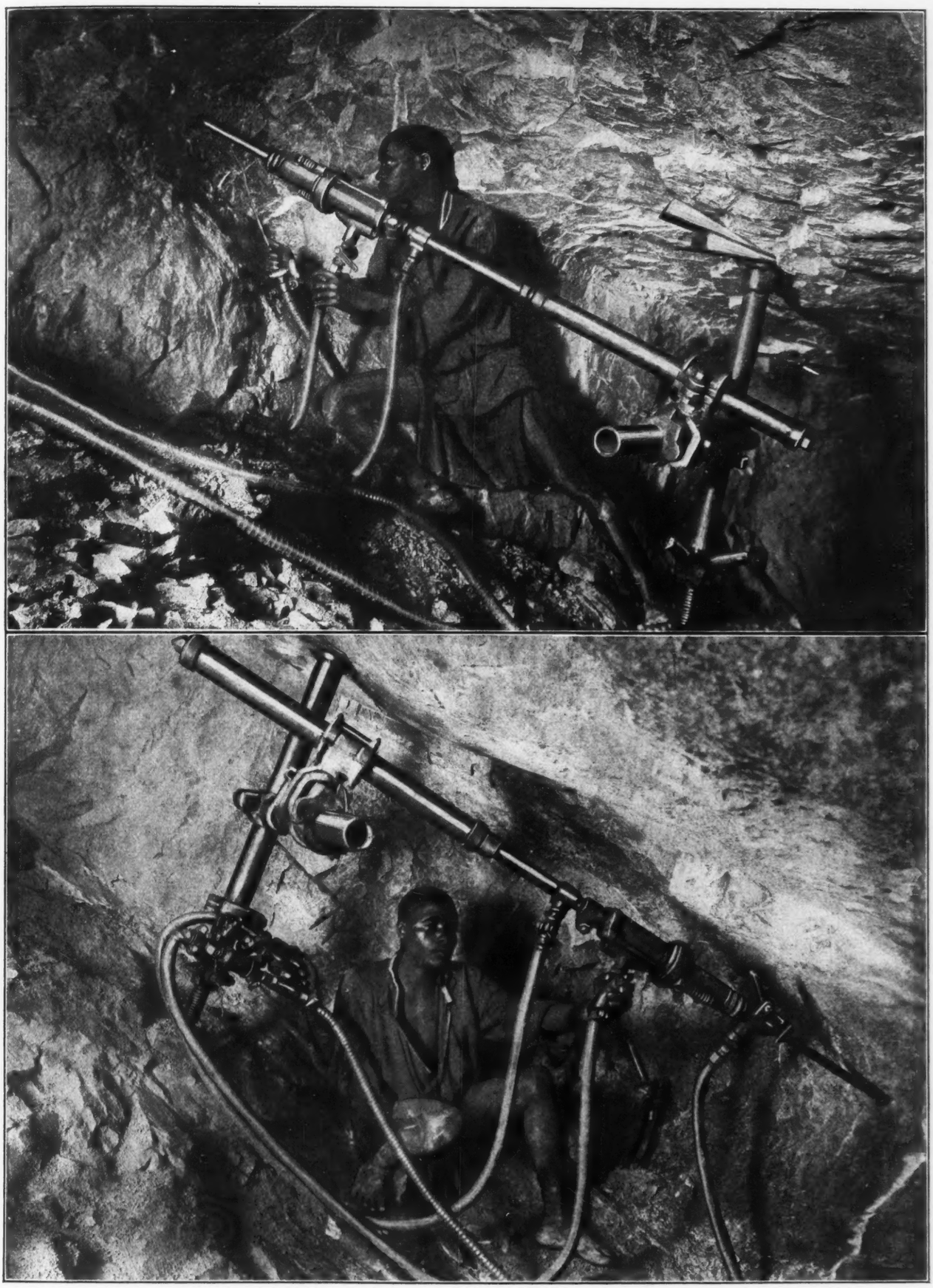
THE NISSEN HUT, A KNOCKDOWN SHELTER FOR SOLDIERS, INVENTED BY A MINING ENGINEER

"Somewhere in France," shelter from storms for the troops behind the line was achieved in the Nissen hut devised by Peter N. Nissen, inventor of the Nissen stamp and now a major in the British Army. The "hut" has a board floor with a double semicylindrical covering, the outside one being of corrugated iron, the inner of matched boards; the only openings are at the ends. It may be knocked down, transported readily and erected with a spanner wrench—thus serving as a standardized, quickly available shelter for 24 men. During the day, bedding is rolled to the side and the hut may be used as a mess hall



COFFEE CREEK DREDGE OF THE YUKON GOLD CO. IN TRINITY COUNTY, CALIFORNIA

Machinery for this 9-cu.ft. steel-hull dredge was furnished by the Marion Steam Shovel Co., of Marion, Ohio. The erection was done by the Pacific Gold Dredging Co., the Yukon Gold Co.'s California subsidiary; the company will operate a fleet of five gold dredges in California this year



FLOTTMANN ONE-MAN DRILLS AS USED IN ONE OF THE RAND MINES
In the top view, a Kafir is driving an upper with solid steel and injecting water with the ½-in. Mannesmann tube

Details of Milling and Smelting

Air-Lift Data Tabulated

By A. W. Allen*

The accompanying data on air lifts have been put into tabular form in order that they may be more conveniently referred to when necessary. The figures of principal importance are given.

AIR PRESSURE TO OPERATE LIFTS

Lift, Ft.	Submergence, Ft.	Theoretical Gage Pressure in Lb. per Sq.In. to Elevate Fluid of Sp.Gr. 1,000	1,100	1,200	1,300	1,400	1,500
5	7.5	3.2	3.6	3.9	4.2	4.5	4.9
10	15.0	6.5	7.1	7.8	8.4	9.1	9.7
15	22.5	9.7	10.7	11.6	12.6	13.6	14.5
20	30.0	13.0	14.3	15.6	16.9	18.2	19.5
25	37.5	16.2	17.8	19.4	21.0	22.7	24.3
30	45.0	19.5	21.4	23.4	25.3	27.3	29.2
35	52.5	22.7	25.0	27.2	29.5	31.8	34.0
40	60.0	26.0	28.6	31.2	33.8	36.4	39.0
45	67.5	29.2	32.1	35.0	38.0	40.9	43.8
50	75.0	32.5	35.7	39.0	42.2	45.5	48.7
5	10.0	4.3	4.7	5.2	5.6	6.0	6.5
10	20.0	8.7	9.6	10.4	11.3	12.2	13.0
15	30.0	13.0	14.3	15.6	16.9	18.2	19.5
20	40.0	17.3	19.0	20.8	22.5	24.2	25.9
25	50.0	21.6	23.8	25.9	28.1	30.2	32.4
30	60.0	26.0	28.6	31.2	33.8	36.4	39.0
35	70.0	30.3	33.3	36.4	39.4	42.4	45.4
40	80.0	34.6	38.0	41.5	45.0	48.4	51.9
45	90.0	39.0	42.9	46.8	50.7	54.6	58.5
50	100.0	43.3	47.6	52.0	56.3	60.6	64.9

An increase in pressure of from 10 to 20% over the figures given will be necessary in practice.

AVERAGE CAPACITY OF AIR-LIFTS

Diam. of Lift Pipe	Cu.Ft. per Min.	Tons per 24 Hr. with Fluid of Sp.Gr. 1,000	1,100	1,200	1,300	1,400	1,500
2 in.	6	270	297	324	351	378	405
2½ in.	10	450	495	540	585	630	675
3 in.	14	630	693	756	819	882	945
3½ in.	20	900	990	1,080	1,170	1,260	1,350
4 in.	25	1,125	1,237	1,350	1,462	1,575	1,687
5 in.	40	1,800	1,980	2,160	2,340	2,520	2,700
6 in.	56	2,520	2,772	3,024	3,276	3,528	3,780

The Coniagas Mill

The report of the Coniagas Mines, Ltd., for the year ended Oct. 31, 1916, shows that the concentrating mill was operated for 95.83% of the possible time, as compared with 98.83% for the previous year, and 85.24% of the total time, as compared with 82.85% for the previous year. The total tonnage milled was 56,973 tons, an average of 3.04 tons per stamp per 24 hours. There was 492 tons, dry weight, of high-grade concentrates shipped, and 152.4 tons, dry weight, of low-grade slimes, the former averaging 2276.6 oz. per ton and the latter, 329.8 oz. per ton. The mill heads for the year average 25.76 oz. per ton.

The sand tailings from the mill average 3.33 oz. per ton and the slimes tailings 4.90 oz. The average for the general tailings was 3.99 oz. A recovery of 131.3 tons of slimes concentrates containing 26,986 oz. of silver was made in the canvas plant, which was erected to re-treat the slimes. Forty-four tons, containing 8968 oz., was shipped to the Coniagas Reduction Co., and 87.3 tons, containing 18,018 oz., was treated in the cyanide mill.

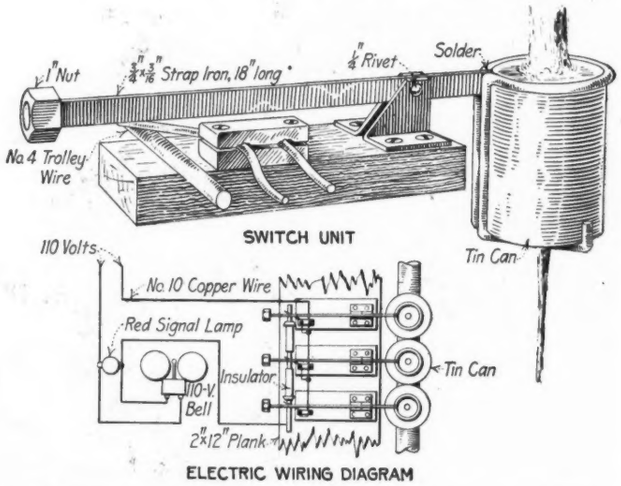
Cyanidation of canvas-table concentrates and of the primary slimes from the mine was begun Feb. 26, 1916, and was continued during the remainder of the year. During this period 87.3 tons, dry weight, of canvas-table concentrates, averaging 206.4 oz. per ton, and 889.3 tons, dry weight, of mine slimes averaging 81.62 oz. per ton was treated, or a total of 976.6 tons, dry weight, containing 81,916 oz. of silver, of which 71,731.24 oz. of silver was recovered. There was a total of 3.5 tons of precipitate shipped which averaged 20,949.6 oz. per ton. The Coniagas mine is one of the large producers of the Cobalt district, Ontario, and one of the pioneers.

*Metallurgical engineer, 309 Broadway, New York.

Cooling-Water Alarm for Transformers

By A. C. Daman*

The three main transformers of a mine in Nevada were cooled by water supplied by neighboring springs. As there were frequent breaks in the connecting water line, the danger of burning out transformers (which were fully loaded) became too frequent for comfort. To indicate water shortage at any one of the three transformers, the device illustrated was designed. It is extremely simple, consisting of an ordinary lever with a can having a small hole in the bottom at one end and suitable



SWITCH UNIT AND WIRING DIAGRAM FOR COOLING-WATER ALARM

counter-weight at the other. When the water from the transformer is running, it will fill the can and thus lower the lever on its end. The size of the hole in the bottom of the can is such that the water runs out slower than it runs in, thus causing the can to overflow. When the water stops flowing, the can will drain itself, and the weights are so arranged that the end opposite the can will lower and make an electrical contact. This is connected to a red signal light and 110-volt bell. A transformer cooling-water alarm is essential where the transformers are heavily loaded or in hot climates, for they will burn out in a short time if cooling ceases.

*Mining engineer, 2678 Eudora St., Denver, Colo.

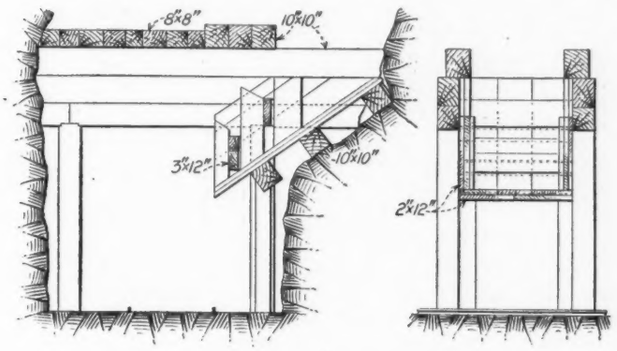
Details of Practical Mining

Construction of Chutes

By James E. Harding*

Early in the operation of the Dairy Farm mine in California, it was found that chutes, to stand the heavy weight of the rock and the constant blasting, had to be very strong. Several types and variations of types were tried, and finally that shown in the accompanying illustration was adopted as best for all purposes.

When the chute raise is driven to a sufficient height, the chute is constructed directly in the mouth of the raise. First, two drift sets are placed 4 ft. apart in the clear and blocked. Upon each cap are placed two 10x10-in. stulls, the first one directly above the cap and resting on it. The second stull is placed on the first and inset 4 in. toward the center of the chute to protect the ends of the plank forming the side of the chute. The bottom of the chute is sustained by 10 x 10-in. crosspieces, held up in turn by posts or solid ground, whichever is the handier. The sides and bottom of the chute are made of 2 x 12-in. plank laid double and overlapping each other by half their width. Overhead on the drift timbers, 8 x 8-in. lagging is laid to close the space over the drift to the two 10 x 10-in. timbers which act as bumpers for the chute mouth. For gates 3 x 12-in. plank is used. This type of chute has been found to be sufficiently strong to stand all shocks received. There are chutes in the mine, still in good condition, which have been blasted over a hundred times and through which several thousand tons of ore has been drawn.



CHUTE USED AT THE DAIRY FARM MINE

It is not to be understood that the blasting is done recklessly or heavily. Generally one stick of powder is sufficient to break any rock encountered when drilled, and in bulldozing with several sticks, the powder is placed in such a way that the timber will not be hit a direct blow. Men employed as chute blasters are specially selected. Intelligence is the prime requisite.

For building these chutes the amount of labor required is four timberman shifts. The approximate quantity of timber is 95 to 100 lin.ft. of 10x10-in., 45 lin.ft. of 8x8-in., 120 lin.ft. of 2x12-in. plank and 7 ft. of 3x12-in. for gates. These gates are frequently broken by shooting and have to be replaced. The use of 3x12-in. plank for gates in place of 2x12-in. saves about 90% in the amount of lumber used for this purpose.

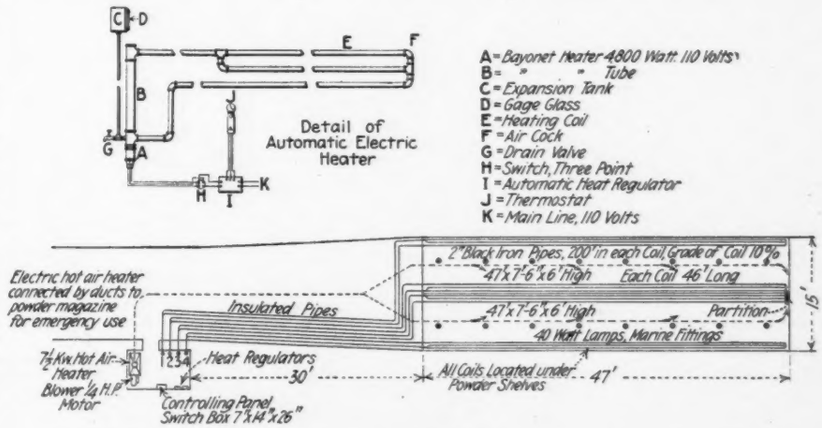
*Care of American Smelting and Refining Co., Caldera, Atacama, Chile.

Electric Heating Plant for Powder Magazines

By Alvin L. Erickson*

The electric heating system used in the powder magazine on the No. 5 level of the Perseverance mine of the Alaska Gastineau Mining Co., was devised by Carl E. Fellstrom, electrical foreman of the Perseverance mine. This system is now in successful operation and heats a magazine having a capacity of about 20 tons of powder. The system is safe and dependable.

This magazine is divided into two separate compartments, each 47 ft. long, 7 ft. 6 in. wide and 6 ft. high. There are two hot-water coils and a thermostat in each compartment—one coil on each side of the compartment. Four Bayonet heaters, which are electrical appliances for heating water, are placed in a station 30 ft. away from the magazine. Each one of these heaters supplies the hot water for one of the coil units in the powder magazine. The automatic controller, expansion tank, four three-point heat-controlling switches and the main line switch are also contained in the station. One coil in each compartment is in constant operation, while the other coil is used



AN ELECTRIC HOT-WATER HEATING SYSTEM FOR UNDERGROUND POWDER MAGAZINES

*115 Eighteenth Ave., North, Seattle, Wash.

to govern the heat and is connected with the thermostat which is installed in the compartment.

Each Bayonet heater has three points of regulation—low, medium and high. These heat regulations are controlled by the four three-way switches. By throwing in all the heat at one time, a maximum temperature of 118° F. can be attained, thus affording ample protection in case of extreme weather. It is of course understood that this temperature can be attained only by throwing out the heat-controlling device, as the thermostats are set to only allow a maximum of 90° F. Under ordinary conditions setting the three-way switches at the "low" position has been found to amply take care of the requirements.

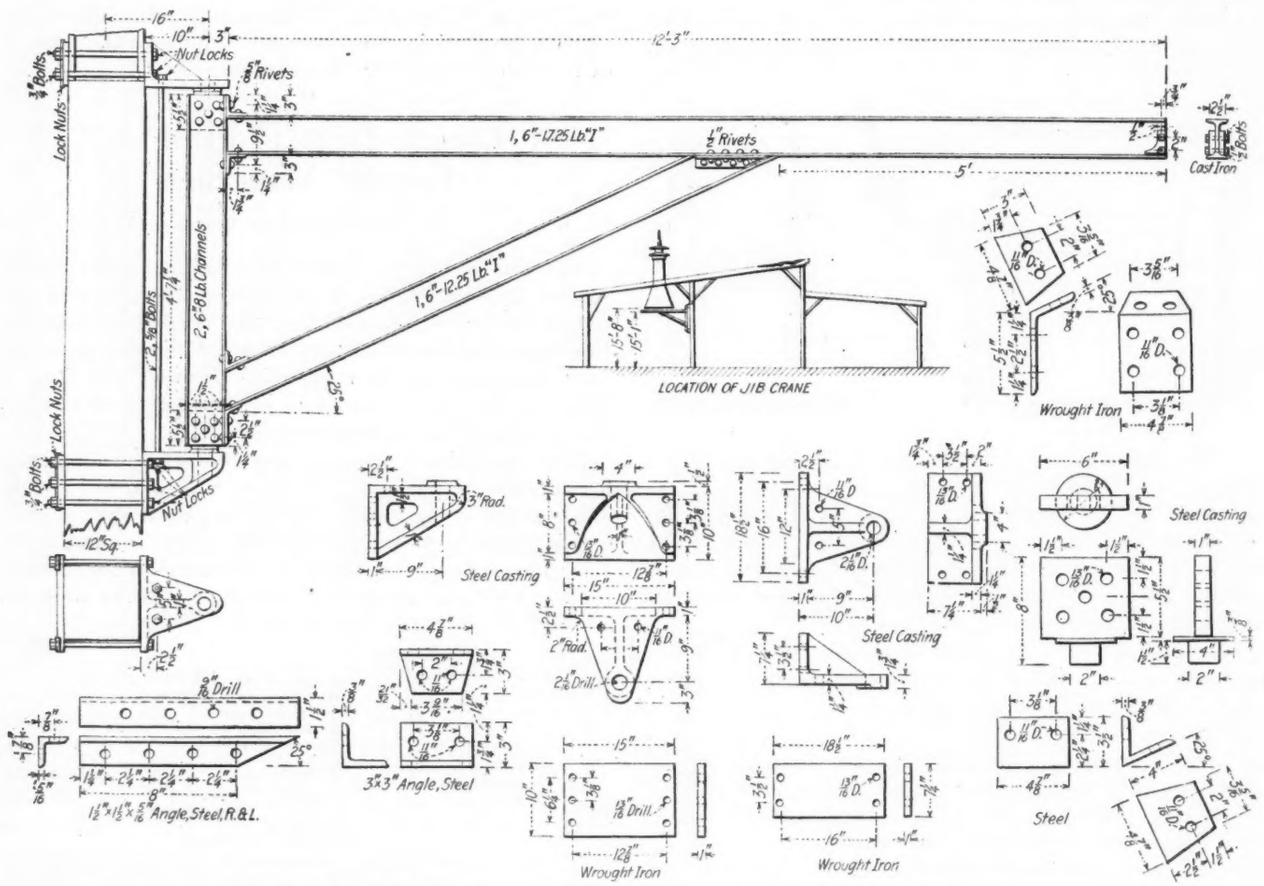
The heat-controlling device consists of an aluminum expansion band connected to a brass strip at the end of which are platinum contact points which make and break contact with a solenoid which in turn is connected to

How To Build a 2000-Pound Jib Crane

It sometimes happens that a small jib crane is wanted where, for some reason or other, it is not easy to buy one. For these cases the design of a 2000-lb. crane that has proved successful in several railroad shops may be of real value, as full details are given in an article by Joseph K. Long in the *American Machinist* for Mar. 15, 1917.

Nearly all roundhouses are built from similar design, with two or sometimes with three 10 x 12-in. square posts supporting the structure between the inner circle and the outer wall. These posts can also support a crane of this type. In order to lift or remove piston valves, steam chests, pistons, cylinder heads, front ends, etc., we built and put in use several of these cranes.

The brackets are steel castings. The lower bracket is securely bolted to the post by six ¾-in. through bolts.



COMPLETE DETAILS FOR THE CONSTRUCTION OF A 2000-LB. JIB CRANE

necessary levers which control the switch operating the Bayonet heaters. The solenoid is wound for operating on 110 volts a.c. The expansion tank has a capacity of 5 gal., which is more than ample as evaporation is practically negligible. A gage-glass is installed on the tank for protection. Ventilation is provided in the magazine by an 8x12-in. air shaft running up from the ceiling in each compartment, with a slide gate in front of each shaft to form a means of regulation.

In case something goes wrong with this electric hot-water heating device, an electric hot-air heater is also installed in the station. A blower, driven by a ¼-hp. motor, forces the hot air into the magazine compartments through ducts which are provided for the purpose.

while the upper bracket has four. Each bracket has bosses; and the piece, which is set in them, forms the pivot for turning the crane. Two 6-in. 8-lb. channels are riveted to the pivot. Both the long top arm and the brace are secured to these channels by ⅝-in. rivets and angles, as shown. Two long ¾-in. rods are used and one quite important one next to the post to keep the brackets from spreading. The top of the long arm, 12 ft. 3 in. in length, just clears the smoke jacks in the round engine house, while the under side is a couple of inches above the height of the top of the smokestack. As the center of the pivot is 10 in. from the post, the crane can be swung way back, making the handling of materials much more easier.

Events and Economics of the War

We have instituted this new department to run while the war is in progress, in which will be summarized a record of the events and the expression of economic opinions that have a direct, or even indirect, bearing upon the mining and metallurgical industries of the United States.

Progress of the War

The United States formally declared war on Germany, Friday, Apr. 6, and thereupon the German ships in American ports were seized. The President issued a proclamation of the state of war, notifying German subjects in this country that they would be unmolested so long as they were quiet and did not try to aid the enemy, but Germans residing within half a mile of forts, navy yards, and some other specified places were required to remove. On Apr. 9 Austria-Hungary severed diplomatic relations with the United States, the latter then promptly siezing the Austrian ships in American ports. American aviators serving in the Lafayette Escadrille raised the American flag at the front in France. Preparations were made for the introduction in Congress of a bill authorizing a bond issue of $5,000,000,000 at 3½%, two-fifths for our own purposes and three-fifths for the Allies.

How Best To Help the Allies in Europe

The war is of such magnitude as to tax the very resources of Nature herself; hence, if prolonged, the necessity for economy in consumption and stimulation of production is for us quite as necessary as if you were not taking part, says the London financial correspondent of the *Evening Post*. Briefly summarized, the best opinions in London, while considering American participation in the war as insuring victory, believe that the first essential, and the one on which the duration of the war depends, is the closest, most intelligent and most skillful coöperation of America and her allies; we profiting by your help, you by our experience of the last two and a half years. There must, however, be complete understanding, both on general principles to be employed and on methods of procedure.

A method of giving money to the Allies without indelicacy, says Norman Hapgood in the *Evening Post*, would be to take over the total cost of relief work in Belgium and northern France, the past cost as well as the future. America has the credit for having done that relief work, but as a matter of fact, the French and British have paid most of the money. France has already paid $250,000,000 for this work, and the future cost will be $15,000,000 a month. A good plan would be to put $1,000,000,000 in the hands of an American commission for French reconstruction. The men who did the Belgian work are now free to take over such an enterprise. They are experienced and on the spot. We hope here (in London) that the American public understands the difference that the French feel between accepting service and accepting money outright. It would, all Englishmen feel, be a terrible disaster were America diverted from its principal task of getting food and supplies to the Allies in order to concentrate upon raising an army.

Flivvers To Be Built

The Federal Shipping Board's program of building a fleet of 1000 wooden ships of 3000 or 3600 tons each has been formally approved by President Wilson. Contracts have been made and the first ship will be ready within five months. The board will call upon the Treasury for from $10,000,000 to $15,000,000 within the next few days. Fifty million dollars already has been authorized by Congress for the work of the board.

By October the shipyards on the Atlantic and Pacific will be turning out the new vessels at the rate of two or three a day to be leased to private shipping concerns. The program calls for the building of 200,000 tons of shipping monthly.

Herbert C. Hoover

Director Gifford of the Council of National Defense announced on Apr. 7 that Herbert C. Hoover, who has won universal praise for his conduct of relief work in Belgium, has been designated to head a commission on food supply and prices. The duties of Mr. Hoover at the outset will be to give to the council the benefit of his knowledge of European food conditions. Later, if conditions justify it, it is understood Mr. Hoover may occupy a position approximating that of food administrator. The resolution, by which the Council of National Defense named Mr. Hoover to take charge of the food problem, follows:

Resolved, That Herbert C. Hoover be requested to take the chairmanship of a committee on food supply and prices, which shall report to the council such experience as European governments have had and advise as to proper methods of preventing recurrence, so far as practicable, of the evils arising out of speculative prices and to stimulate increased production of all food supplies.

According to a cable dispatch from London Apr. 9, 3 p.m., Mr. Hoover had received no confirmation of the Washington report that he would be requested to head a committee to take up the food problem in the United States. On this account, he said he did not feel justified in discussing it. At present his time is occupied with efforts to insure the safe arrival of relief ships at Rotterdam.

It is of great interest to record what Mr. Hoover cabled to President Wilson on April 3, this being as follows:

The members of the American Commission for Relief in Belgium ask me to transmit to you an expression of united devotion and of our admiration for the courage and wisdom of your leadership. We wish to tell you that there is no word in your historic statement to Congress that does not find a response in all our hearts.

For two and a half years we have been obliged to remain silent witnesses of the character of the forces dominating this war, but we are now at liberty to say that, although we break with great regret our association with many German individuals who have given sympathetic support to our work, yet

your message enunciates our conviction, born of our intimate experience and contact, that there is no hope for democracy or liberalism, and consequently for the real peace and safety of our country, unless the system which brought the world into this unfathomable misery can be stamped out once for all.

Financial Considerations

The response of the stock market to the President's message was not so vigorous as had been expected by most brokers and bankers, and was attributed to unwillingness of speculators and operators to make additional commitments until the Government threw some light on the methods by which it hopes to pay for carrying on war. Operators said there would be no incentive to purchase industrials on the expectation of larger earnings if the Government intends to tax their profits heavily. Prominent bankers agree that a portion of the money needed should be raised through taxation, but add that industry should not be taxed so heavily as to kill enterprise and the inducement to work.

It is believed that the war will be scientifically financed, but if our Congress proceeds upon the theory that the main source of supply in providing the sinews of war is to be found in excessive taxation of corporations, then capital in this country will not move into enterprise as it would under other conditions, says the New York *Sun*. Tax the nation's prosperity beyond a certain limit, and you cut down the plum tree in order to gather only the best of the fruit. Tax legitimate profits in business beyond a certain limit instead of making the entire people bear the burden, and you tax the source of prosperity to an extent that will stunt commercial growth.

"The success of this and of succeeding bond issues, in my opinion," a leading banker said, "depends largely on the scheme of taxation which the Government adopts. Rich men should be taxed, to be sure, and the exemption limit of the income tax should be lowered, so that men of moderate means shall bear their part. But it would be a great mistake to lay such heavy taxes that industry would be chilled and enterprise dismayed. In that case, we might see something resembling a strike of brain-workers. Capital demands something more than a 'fair return.' It insists upon having a return commensurate with the risk involved. Their exist numberless fields which have not been touched by taxation."

As yet we are entirely in the dark as to what basis the Government would use in making its credit advances to the Allies. In the opinion of one banker we may advance to the Entente nations whatever is needed to finance their purchases here and protect the exchanges. Another financier believed that we would merely advance a lump sum, to be used under the direction of our Government in paying for munitions. In that case, our own Government might regulate the price which manufacturers shall charge for supplies sold to Europe, and see that no waste or excessive charges occurred.

A very mean and base conception of the facts is exhibited, says the *Evening Post,* by the group of carping critics who have instantly begun to talk about the "pocket nerve," and point triumphantly to a 4 or 5% decline on the Stock Exchange as proof that Wall Street's patriotism has been "dollar patriotism," and is now being chilled by the prospect of financial burdens. The stock market is a complex organism, whose variations reflect its view of immediate intrinsic values, as well as its view of larger general influences. What has occurred on the Stock Exchange this week reflected simply the first confusion of ideas as to which was the predominant influence of the moment on the attitude of investors. There will be abundant time for the financial community to appraise both influences. The first and most powerful offset to the uncertainty of sentiment shown this week will come on consideration of the extent to which the plans for military preparedness on the large scale will guarantee the national security in a war with so resourceful, desperate and unscrupulous an antagonist. Nowhere has the assumption of our half-hearted and restricted participation in the war produced more effect than in official Germany, which has used that assumption to prove that America would be negligible in the European conflict. Nowhere has the absence of such preparedness been more frequently insisted on, as a dangerous condition in a country on the verge of war, than in our own financial circles. With the declaration of war come prompt and comprehensive measures to correct that part of the situation. It is impossible that this consideration should not be reflected in financial sentiment. How far it will offset other legitimate considerations, it remains for the market to show. But no one need wait for the movement of the coming weeks or months on the Stock Exchange to learn the real financial view, first, regarding the capacity of our immensely prosperous and well-organized finance to meet all necessary requisitions on it, and second, regarding the manner in which our international power and prestige have been fortified by our bringing of Germany to a final reckoning.

Organization of the Railways

A plan for the mobilization of the country's 250 railroads has been completed by the special committee on national defense of the American Railway Association. Fairfax Harrison, president of the Southern Railway, is chairman of the special committee. Heading sub-committees are L. F. Loree of the Delaware and Hudson, R. H. Ashton, of the Chicago and Northwestern, W. B. Scott of the Southern Pacific lines in Texas and Louisiana, and William Sproule of the Southern Pacific. It will be possible, under arrangements made by the railway men, to operate all the roads of the United States practically as one system at any time that it is necessary. The plan provides for the closest coördination between the railroads and the military authorities.

The railroads are placed completely at the disposal of the Government, that is, the Government may have the use of the systems for the movement of any number of troops at any time. Every other sort of traffic will give way to the requirements of the Government. Responsibility for the prompt and effective movement of trains, however, will remain with the railroads. While the railroad officials are ready to give over their systems exclusively to the use of the Government should occasion demand it, they are of the opinion that normal business will not be greatly affected, since such elaborate preparations have been made to take care of any emergency.

How England Pays for War*

President Wilson's recommendation to Congress on Monday that adequate credits be granted to the Govern-

*From the New York "Evening Post."

ment, sustained, "so far as they can equitably be sustained by the present generation, by well-conceived taxation," has aroused fresh interest in the war-time revenue measures of England. It is naturally believed that the Administration officials have studied the taxation methods of Great Britain, both to ascertain the sources and the means chosen for increased levies and to determine the revenue received from each source.

Great Britain raised its first funds for carrying on the war from the sale of Treasury bills, followed by the loan of November, 1914. In that month the Chancellor of the Exchequer presented the first war budget, which doubled the income tax and super-tax, raised the tax on beer from 7s. 9d. per bbl. to 25s., and increased the tax on tea from 5s. to 8s. These measures resulted in raising the national revenue from 198 to 227 millions sterling.

In September, 1915, the second war budget was introduced, providing drastic increases in taxes. The income tax, which had already been exceptionally high before the war because of the government's extensive plans for social betterment, was raised by nearly half the amount previously levied. The tax on moderate incomes from investments rose to 17½% of the income—nearly three times the pre-war level—with a graduated "super-tax" on large incomes of $500,000 or over to no less than 34%. Later a tax on war profits of 50% was also imposed. This tax was levied on the excess profits above the average of the best two out of three years before the war began. Excise or import taxes ranging from 30 to 100% were imposed on a number of articles. The tax on sugar was raised from 1s. 10d. per cwt. to 9s. 4d. A 50% tax was placed on tea, tobacco, cocoa, coffee, chicory and dried fruits. A tax of 3d. a gallon was placed on gasoline, "motor spirit." The tax on patent medicines was doubled. An ad valorem duty of 33⅓% was placed on imports of motor cars and cycles, motion-picture films, clocks, watches, plate glass, musical instruments and hats.

The reception of these budget proposals on the Stock Exchange is described by the London *Economist:*

> The Stock Exchange recognizes frankly that the new taxation proposals must cut into its business still more deeply, acknowledges that the necessity for domestic retrenchment and economy is a bad thing for its markets, and admits with candor that it is difficult to see from what direction new business can be expected to arrive. It praises, notwithstanding, the taxation proposals, considering them to be, on the whole, a fair and equitable adjustment of the burdens imposed by the war.
>
> Though spirits revived, quotations eased off. There was not much pressure to sell, but what little there was sufficed to demonstrate what may be expected. The taxpayer begins to look ahead to next January, when he will be called upon for the first installment of the extra amounts demanded. He reads into Mr. McKenna's speech the practical certainty of another war loan being issued—it may be before the next batch of income-tax claims is sent out; and on whatever terms the new loan is offered, it must act as a competitor with existing securities and have a lowering effect upon their quotations. Consequently, he is asking his broker whether it may not be worth while to sell now, in intelligent anticipation of another such all-round decline as took place last June, when the 4½% war loan appeared.

For the period of the war, England has raised about 25% of her war costs out of taxation. From Aug. 1, 1914, to Mar. 31, 1915, 858 million dollars was raised by taxation and 2025 million by bonds and other forms of borrowing. From then until Mar. 31, 1916, 1685 million dollars was raised by taxation and 5820 million by borrowing. From then until Mar. 31, 1917, 2475 million was raised by taxation and 7310 million by borrowing. For the entire period of war England has thus raised 5010 million dollars by taxation and borrowed 15,160 million. In the period from Apr. 1, 1913, to Mar. 14, 1914—embracing all but three weeks of the last British fiscal year before the war—total revenue of the United Kingdom was $993,000,000; in the period from Apr. 1 1916, to Mar. 10, 1917, the revenue amounted to $2,566,000,000. In the earlier year, customs duties produced $169,000,000, compared with $331,000,000 in the year now closing; excise, $188,500,000, against $261,000,000; estate duties, $131,000,000, which this year increased to $146,000,000; the returns from property and income taxes were raised from $210,000,000 to $898,000,000; while this fiscal year the "excess profits" tax has produced $635,000,000. These items, the principal ones in the revenue returns, indicate the sources from which Great Britain has chiefly derived its increased income.

Purchase of Material

The Council of National Defense on Apr. 9 appointed a general munitions board, with Frank A. Scott, a Cleveland manufacturer and munitions expert, as its head. The task of the new board will be the arming and equipping of the forces the United States calls into service. Mr. Scott, who will have associated with him other prominent business men, will have virtually the power and functions of a secretary of munitions except that the actual signing of contracts will remain with the War and Navy Departments. He will have with him on the board representatives from the following committees of the advisory commission of the Council of National Defense: Raw materials, Bernard M. Baruch; industrial, Howard E. Coffin, Detroit; supplies, Julius Rosenwald, Chicago; medicine, Dr. Franklin H. Martin, Chicago. Representing the army on the board will be Gen. Thomas Cruse, Col. F. G. Hodgson, Col. H. Fisher, Lieut.-Col. J. E. Hoffer, Major P. E. Pierce, Major Charles Wallace and Capt. A. B. Barker. Naval officers on the board will be Admiral H. H. Rosseau, Admiral W. S. Capps, Commander R. H. Leigh, Commander T. A. Kearney, Dr. S. C. Holcomb, Paymaster J. H. Hancock and Lieut.-Col. W. B. Lemly. L. McH. Howe, secretary to Assistant Secretary Roosevelt, also will be a member.

The immediate efforts of the new board will be to coördinate the purchasing agencies within each department and also to coördinate the purchases of the two departments. The board will assit in the acquirement of raw materials and of manufacturing facilities and will establish the precedence of orders between the Departments of War and Navy and between the military and industrial needs of the country. Present contracts will not be disturbed, nor will the order of delivery where that has been arranged, unless it is necessary to make changes to cover any requirements which may develop. Officials of the Council of National Defense said that it would be the aim of the board to disturb the normal industrial process of the country as little as possible in equipping and arming the forces called into service.

The copper companies that signed the agreement to supply the Army and Navy with 45,000,000 lb. of copper at 16.6739c. per lb. are the following: Anaconda, Braden, Calumet & Arizona, Cerro de Pasco, Chile, Chino, East Butte, Greene-Cananea, Hancock Consolidated, Inspiration, Kennecott, Magma, Miami, Mohawk, Nevada Consolidated, North Butte, Old Dominion, Phelps Dodge &

Co., Quincy, Ray Consolidated, United Verde, United Verde Extension, Utah Consolidated, Utah, Wolverine.

Prices at which the steel companies have agreed to sell steel to the Navy Department were announced Apr. 7. They are 2.90c. per lb. for plates and 2.50c. for bars and shapes. This is a concession of $50 a ton from the prices recently current, or a saving of $18,000,000 to $20,000,000 for the Government on the purchase of 300,000 tons of steel which, it is stated, the Navy Department has thus far contracted for. These prices are practically the same as paid by the Government in 1916. It is expected in the steel trade that fully 1,000,000 tons of steel will be speedily contracted for by the Government to meet military needs.

Negotiations are now in progress with the producers of zinc, lead and aluminum.

Committees on brass and aluminum have been appointed to serve in conjunction with the committee on Raw Materials composed as follows:

Brass—Charles F. Brooker, president of the American Brass Co., Waterbury, Conn.; C. D. Goss, president of the Scovill Manufacturing Co., Waterbury, Conn.; Lewis H. Jones, president of the Detroit Copper and Brass Co., Detroit; Barton Hazelton, secretary and treasurer and general manager of the Rome Brass Co., Rome, N. Y.; F. J. Kingsbury, president of the Bridgeport Brass Co., Bridgeport, Conn.

Aluminum—Arthur F. Davis, president of the Aluminum Company of America, New York; E. E. Allyne, president of the Aluminum Castings Co., Cleveland; Joseph A. Janney, of Janney, Steinmetz & Co., Philadelphia.

The Part of Organized Labor

The following is a list of what is tabulated in Great Britain from which skilled workers should not be drawn into the Army: Batteries, bleaching and dyeing, breweries, brickyards, brushmaking, button industry, candles, grease and tallow; cement and lime; charcoal, chemical industry, coke, cooperage, engineering, food, foundries, furniture, glass, hat, iron and steel; jewelry, cheap grades; leather, linoleum, lumber and timber; malting, mattresses and spring beds; metals, military insignia, motor-car industry, munitions, needles, oil and coke mills; oil extracting, packing industry, paint, paper, petroleum, pianos, pottery, powder, printing, rubber, sand bags, sawmills, shipbuilding, soap industry, stone, surgical dressing, surgical appliances, textiles, tobacco, toymaking and games; waters, aerated; wire rope, woodworkers.

It should not be taken for granted that all the items mentioned in this list are necessary in time of war, but the men employed in their manufacture are in most cases trained workers whose experience readily adapts them for other lines. Therefore, it is probable that the United States will be able to strike many of these industries from the list, while it is probable that others will have to be added to it. While in some lines of work men may be replaced by women, others will need, it is said, a greatly increased force of men workers. If men are enlisted indiscriminately from all trades and industries, experts look for a shortage of certain necessities, and much valuable time will be lost in training other workers to fill the places of those who have been sent to the front.

A plea to the employers of the country and their workers not to seek to change existing standards of employment while war conditions prevail was issued Apr. 8 by the Council of National Defense.

The action was taken in accordance with the recommendation of the committee of labor, of which Samuel Gompers, of the American Federation of Labor, is chairman. In submitting the report of the committee which was approved by the council, Mr. Gompers virtually pledged the support of organized labor throughout the country to the Government in the war with Germany. The text of the recommendations of Mr. Gompers and his committee follows:

The defense and safety of the nation must be the first consideration of all patriotic citizens. To avoid confusion and to facilitate the preparation for national defense and give a stable basis upon which the representatives of the Government may operate during the war, we recommend:

1. That the Council of National Defense should issue a statement to employers and employees in our industrial plants and transportation systems advising that neither employers nor employees shall endeavor to take advantage of the country's necessity to change existing standards. When economic or other emergencies arise requiring changes of standards, the same should be made only after such proposed changes have been investigated and approved by the Council of National Defense.

2. That the Council of National Defense urge upon the legislatures of the states as well as all administrative agencies charged with the enforcement of labor and health laws, the great duty of rigorously maintaining the existing safeguards as to the health and welfare of workers, and that no departure from such present standards in state laws or state rulings affecting labor should be taken without declaration of the Council of National Defense that such departure is essential for the effective pursuit of the national defense.

3. That the Council of National Defense urge the legislatures of the several states that before final adjournment they delegate to the governors of their respective states the power to suspend or modify restrictions contained in their labor laws when suspension or modification shall be recommended by the Council of National Defense; and such a suspension or modification when made shall continue for a specified period and not longer than the duration of war.

The recommendations were unanimously approved and adopted by the council and advisory commission.

Cupro-Nickel Scrap

The British Minister of Munitions, in exercise of the powers conferred upon him by the Defence of the Realm Regulations, has issued a notice to the effect that all cupro-nickel scrap shall as from Mar. 13 be dealt with and disposed of in accordance with instructions from time to time given by the Director of Non-Ferrous Rolled Metal Strip and Sheet Supply, Ministry of Munitions, Whitehall Place, London, on behalf of the Minister.

No person shall as from the appointed day sell, offer for sale, use or otherwise deal with or dispose of any cupro-nickel scrap, whether in pursuance of a contract existing prior to the appointed day or not, except under and in accordance with the terms of a licence granted by the Director on behalf of the Minister.

All persons shall, on or before Mar. 24, 1917, furnish to the Director a statement in writing giving particulars of all cupro-nickel scrap in their possession or under their control on the appointed day, and of all their existing contracts and orders for the purchase or sale of cupro-nickel scrap, says the *Iron and Coal Trades Review*.

The term cupro-nickel scrap for the purpose of this Order includes all kinds of cupro-nickel webbing scrap, process scrap, and swarf and scrap of every kind in the composition of which copper and nickel are included, or any of them.

Report of the Nickel Commission

SYNOPSIS—The report of the Royal Ontario Nickel Commission has been made, and constitutes an encyclopedia of information about nickel, its geology, ores, mining, metallurgy and refining. All the known nickel deposits of the world have been examined and studied, the results of the studies indicating that Ontario is likely to continue to hold the commanding position. Taxation is reported to be on a proper basis now, and any great increase is opposed.

The Royal Ontario Nickel Commission, appointed by the Ontario government Sept. 9, 1915, to investigate the resources, industries and capacities of Ontario in connection with nickel and its ores has presented its report. The commissioners are: George T. Holloway, Associate of the Royal College of Science, London, and vice president of the Institution of Mining and Metallurgy, an English metallurgical expert of high repute; Dr. W. G. Miller, Provincial Geologist; and McGregor Young, K. C., a well-known barrister, of Toronto. Thomas W. Gibson, Deputy Minister of Mines, acted as secretary. A little pink slip at the front of the report informs the reader that in order that it might be placed before the legislature at the earliest possible date, 150 advance copies have been struck off without the last chapter, which is a bibliography of nickel, and the index, but both of these will be included before the report is issued to the public at large. The report proper is a bulky volume containing over 600 pages and is well illustrated with cuts, diagrams and maps. In addition there is an appendix of 219 pages, which contains the evidence of the witnesses who testified before the commission, and a number of papers, memoranda and other matter pertinent to the inquiry.

Principal Questions of Discussion

The commissioners print a summary of the report and their conclusions on the main points of the investigation at the forefront of the volume and thus enable the reader to obtain the gist of the report without difficulty. After reference to the various countries they visited, including the United States, Great Britain, France, Norway, Cuba, Australia and New Caledonia, and to numerous mines, works, plants, smelteries, etc., on this side of the Atlantic and on the other, and also to their interviews and conversations with Bonar Law, then Secretary of State for the Colonies, and other British government officials, the commissioners go on to say:

The two questions that have been uppermost in the numerous discussions that have taken place concerning Ontario's nickel industry during the last 25 years are: (1) Can nickel be refined economically in Ontario? and (2) Are the nickel deposits of Ontario of such a character that this province can compete successfully as a nickel producer with any other country? It will be seen that the commissioners have no hesitation in answering both of these questions in the affirmative.

The report goes on to state that the commissioners are of the opinion:

1. The nickel-ore deposits of Ontario are much more extensive and offer better facilities for the production of nickel at a low cost than do those of any other country. Nickel-bearing ores occur in many parts of the world, but the great extent of the deposits in this province, their richness and uniformity in metal contents and the success of the industry, point strongly to the conclusion that Ontario nickel has little to fear from competition.

2. Any of the processes now in use for refining nickel could be successfully worked in Ontario, and conditions and facilities are at least as good in this province as in any other part of Canada.

3. In view of the fact that practically no chemicals are required, that there is a much more complete saving of the precious metals, especially platinum and palladium, and that electric power is cheap and abundant, the most satisfactory method of refining in Ontario will be the electrolytic.

4. The refining of nickel in Ontario will not only benefit the nickel industry, but will promote the welfare of existing branches of the chemical and metallurgical industries and lead to the introduction of others.

5. The methods employed at the Ontario plants of the two operating nickel companies are modern and efficient, although there are differences in both mining and smelting practice. It is the consistent policy of both companies to adopt all modern improvements in plant or treatment. Even during the present time of acute pressure the Canadian Copper Co. has materially increased its output without substantial enlargement of its plant, and the losses in smelting are less, both at Copper Cliff and the Mond plant at Coniston, than they were a year ago. These companies have each had their experimental stage, neither has asked nor received any Government assistance, and both have earned the success which they have achieved.

6. The present system of mining taxation in Ontario is just and equitable and in the public interest, and is the best system for this province. Any question of change is rather one of rate than of principle. This important question is dealt with at some length in Chapter XII.

7. Experiments have been undertaken by the commission in the production of nickel-copper steel direct from Sudbury ore, and also in the electrolytic refining of nickel. Certain improvements in the latter process have been made the subject of application on behalf of the Government of Ontario for patents in Canada, United States and Great Britain.

Public interest in the nickel question has been, and continues to be, very keen. It has been a matter of popular belief that Ontario has a practical monopoly of the world's nickel, and there has been something like exasperation in the public mind because none of the nickel mined in Ontario was refined in Canada, but that it was being sent abroad, and mostly to the United States.

Nickel Refining in Ontario

The opening chapter of the report deals with the agitation which has gone on from the beginning of the industry in favor of the refining of nickel in Ontario and the various steps which governments or parliaments have from time to time taken to realize this desire; the negotiations with the Imperial government for the same purpose are also summarized. The offer of the Ontario government to the British authorities in 1891, to give the latter a substantial, if not a controlling, interest in the nickel mines of the province, if they would agree to establish refining plants and make nickel-steel here, is recalled. Doubt is cast, not upon the good faith of the offer, but upon the possibility of implementing it, if it included only the nickel deposits at that time remaining in the possession of the Crown. It is stated that most of the great deposits now being worked had already been parted with before the date of the offer. Nevertheless the report says that the action of the government was a notable one, arguing remarkable insight into the future, and "had the offer been met with an equal degree of imagination on the part of Great Britain, it is not easy to say what the results would have been. Even with the deposits found since 1891, a good deal of nickel could have been obtained, and it could always have been possible to purchase privately owned properties."

The commissioners say that at the beginning of their inquiry it was asserted by the companies interested that nickel could not be refined economically in Ontario. They, therefore, naturally express gratification at the assured prospect of the erection in Ontario of two large plants for the refining of nickel. One is now being constructed by the International Nickel Co. of Canada, Ltd., at Port Colborne. The company has obtained a site of 400 acres on which 2000 men are now at work, and is erecting a plant whose initial output will be on the basis of 15,000,000 lb. of nickel per annum, provision being made for doubling or quadrupling this capacity. The matte to be refined here will come from the smelteries of the Canadian Copper Co. at Copper Cliff, for the treatment of which there will be required bituminous coal, coke, fuel oil, niter-cake, and other chemicals and materials, estimated at 100,000 tons annually. The plant is expected to be in operation and turning out refined nickel in the autumn of the present year.

The second refinery is that of the British America Nickel Corporation, Ltd., a company controlled and largely financed by the British government, which has purchased the large Murray mine, the Whistle, and other deposits in the Sudbury region. This refinery will probably be erected at the Murray mine, which is about three miles from Sudbury. The refining process employed will be the electrolytic, otherwise known as the Hybinette process, from the name of the inventor who uses it in the Norwegian works. This plant will have a capacity at the beginning of 5000 tons of nickel per annum.

As to compulsory measures for insuring that the whole of the nickel output of Ontario should be refined within her borders, the commissioners say they are advised that the provincial legislature has not power to prohibit export or to impose an export tax directly, and that the power of the province in effect to regulate export by differential taxation in favor of nickel refined within the province is a matter of grave doubt. The completion and operation of these plants, in the view of the commissioners, especially because of the probable extension of the facilities now being provided, will go far toward a solution of the question of home refining, which has so long exercised the public mind. The output of these refineries, added to the nickel now being produced in England from Ontario matte, will fully meet if not surpass, the entire requirements of the British Empire.

A custom smelter for nickel ore has sometimes been suggested by individual owners of nickel deposits or small companies. The report states that the British America company is prepared to consider this question, and that if such an arrangement could be effected it would answer all probable requirements.

A Custom Smeltery for Nickel Ores

The suggestion has been made in certain quarters that government ownership would solve many of the questions that have been raised in connection with the nickel deposits. The commissioners point out that to expropriate the deposits and plants of the Sudbury nickel area would probably cost not less than $100,000,000, a sum approximately equal to the total paid-up capital of all the chartered banks in Canada. They add:

> There is no certainty that large profits can be made every year from the nickel industry. The present activity is in part due to well-understood causes, which it is to be hoped will never recur. In the past the output has had to be curtailed at times. If the price of nickel should fall, profits will naturally decrease. The nickel industry is to a considerable extent dependent for its success on the highly trained and specialized technical men who superintend it, who command salaries far beyond those which are paid in the Government service to the most highly placed employees. Besides, nickel is not a necessity of life, nor an article of universal consumption or use, and the nickel business is in no way comparable to those connected with the operation of public utilities where Government ownership may be beneficial or expedient. In short, there does not seem to be any good reason why the people of Ontario should be asked to adventure so large a sum of money as would be required for the purchase of the nickel deposits and plants.

The uses of nickel are dealt with in several chapters under the headings: "Properties and Uses of Nickel and Its Compounds"; "Nonferrous Alloys"; "Nickel Steel and Other Alloys of Nickel Containing Iron." The great use of nickel is in the manufacture of nickel steel, the ordinary form of which contains about 3½% of the metal. As compared with ordinary carbon steel, nickel steel has much greater strength and ductility and is used in various forms in a wide range of industrial operations, also in the manufacture of armor-plate, ordnance, projectiles, protective deck plate, gun shields and many other articles of naval and military equipment. Large bridges at New York and over the Mississippi and Missouri Rivers, dams, docks and spillways of the Panama Canal, and other large structures illustrate the usefulness of nickel steel. For locomotive forgings, marine engines and shafting, wire cables, automobile parts, etc., there is a large and growing use. Many alloys of copper and nickel are produced and used for a variety of purposes—for bullet casings, for coinage, plumbers' supplies, etc. The use of nickel in the electroplating of metallic objects is widely known and needs no explanation. As finely divided metal, nickel is employed as a carrier of hydrogen in the manufacture of fats from oils, and this property is largely utilized by soapmakers. Pure nickel is used in coins, in making watch and cigarette cases and cooking utensils. It is also drawn into wire used in spark plugs and electrical leading-in wires. Purchasers and leading consumers in Britain and the United States express the opinion that the uses of nickel will be extended, and that when normal peace conditions are fully restored, the demand will be greater than it was before the war. A reduction of the price would undoubtedly enlarge consumption and require increased production.

The World's Nickel Deposits

Chapter IV, on the "Nickel Deposits of the World," contains 191 pages and is in itself a complete treatise on this subject. The Sudbury deposits are first taken up and their geology, mineralogy and composition fully discussed. The extent of the ore reserves is given at 70,000,000 tons of proven ore, and of proven, probable and possible ore, 150,000,000 tons. Mining methods are described and illustrated. New Caledonia is generally held up as the chief competitor of Ontario in the production of nickel, and the deposits there are dealt with. The ore is different from that of Sudbury and does not contain copper. It is shown that while there is a good deal of nickel in New Caledonia, the mines are small compared with those of Sudbury. The largest mine yet worked contained 600,000 tons; few exceed 250,000 tons, while in Sudbury the large deposits have tonnages ranging up to 45,000,000 tons. The ores as shipped are richer in nickel than those of Sudbury, but are gradually lowering in tenor; they are more expensive to work, are farther

away from markets, and the production is increasing very slowly. While the output of the Sudbury mines has grown ninefold during the last 15 years, that of New Caledonia has increased by only 20%. The conclusion as to New Caledonia is summed up in the following words:

> The essence of the whole matter, in so far as competition from New Caledonia in the open market is concerned, is the cost of the refined nickel produced from these ores. More than a dozen years ago the cost was approximately 19c. per lb.; immediately prior to the war it had not been lowered; at present, with excessive freight rates and increased prices for supplies, the cost is much increased. As long as the price of nickel remains about the same as it has been during recent years, New Caledonia will have an important industry. It will probably expand to some extent owing especially to the activities of the newer of the two companies that are shipping ore and smelting on the island; but there is no good reason for believing that the competition from New Caledonia will become any stronger than it has been in the past. Should the price of nickel fall to 25c. per lb. or less, New Caledonia will have difficulty in keeping her mines in operation.

The nickel mines of Norway are dealt with. They are of the same character as those of Sudbury, but poorer in both nickel and copper. The deposits are small, and the output is not capable of very large expansion. The electrolytic process of refining is employed in Norway, and all the Norwegian nickel since the beginning of the war has been going to Germany.

There are many other countries in the world which contain deposits of nickel ore, including Germany and Austria, France, China, Russia, Egypt, Italy, Tasmania and the United States. Most of these deposits appear to be of limited extent. In Madagascar the ores are similar to those of New Caledonia, but have never been worked. In the Island of Seboekoe, near Borneo, and in Cuba there are large and doubtless important deposits of nickeliferous iron ore. In Seboekoe they have never been worked, while in Cuba operations have been going on for some seven or eight years. Neither, however, can be regarded as a source of metallic nickel, and the shipments from Cuba do not appear to be increasing.

The commissioners conclude that while it is true that Ontario has no monopoly of nickel, it possesses many advantages over all competitors, even under the present conditions of the market as to prices and trade connections. In any keen competition as to prices, it is doubtful whether any locality at present known or suggested could compete with Ontario. It is a matter of record that at one time of low prices the leading New Caledonia company was compelled to suspend its dividends. It may be doubtful, further, whether anything but an arrangement of the market between the great interests can prevent the complete domination of the world's trade by the nickel industry of Ontario making the best use of its exceptional resources.

The Nickel-Producing Companies

A chapter of the report is devoted to the history and development of the principal operating companies connected with the industry in Ontario from its inception. The organization of the Canadian Copper Co. is traced, and the merger of 1902 by which the International Nickel Co. absorbed that company and the Orford works, and thus united under one control the mines and the refining process, is set forth. A table shows the exports of metallic nickel by the International Nickel Co. for the 10 years previous to the war and also for the period from the beginning of the war to Dec. 31, 1916. The former table shows that Germany and Great Britain received the bulk of the exports in pre-war times, and that Great Britain, France, Russia and Italy have taken nearly all the overseas shipments since that time, none going to Germany. Prior to the war, nickel, in whatever country produced, was sold like any other metal wherever there was a market for it and was treated solely as an article of commerce without regard to international relations. A schedule is given showing the countries in which the shares of the International company are held. This covers 89,126 shares of preferred stock and 1,673,384 shares of common stock. The great bulk of the shares are held in the United States, Canada and Great Britain coming next. Only 256 shares of preferred and 452 shares of common stock are held in Germany and Austria. Full details are given of the reorganization of the International company in 1912. On Dec. 31, 1916, the common stock stood at $41,834,600 and the preferred at $8,912,600, making a total share liability of $50,747,200. Another table shows common-stock dividends paid from 1910 to 1916, a total of $30,942,238. The profits from 1903 to 1916 aggregated $39,850,356, total assets $61,230,813. Little further allusion is made to the question of any possible exports of nickel to Germany during the war, the commissioners stating that this question was not within their jurisdiction.

The Mond Nickel Co. operates on a smaller scale than the Canadian Copper Co. It works the Garson, Worthington, Levack, Victoria and Kirkwood mines, the ore from which it smelts at the plant at Coniston, erected two or three years ago. The matte is sent to Clydach in Wales, where it is refined by the Mond process, invented by the late president of the company, Dr. Ludwig Mond. The products of the refinery are metallic nickel, nickel salts and copper sulphate; the market for the last-named is in the vine-growing countries of Europe, where it is used to combat the enemies of the grape.

The Metallurgy of Nickel

Several chapters of the report are devoted to a description of the metallurgy of nickel, the roasting and smelting of the ore and the bessemerizing of low-grade matte. The bessemer matte contains about 80% of nickel plus copper, the Canadian Copper Co.'s product containing about 53.5% nickel and 25% copper. That of the Mond company is lower in nickel and higher in copper, containing about 40 or 41% of each. The Orford, Mond and electrolytic refining processes are described and compared, the commissioners remarking that the respective costs of producing refined nickel from the Sudbury ores by each of the three processes mentioned do not differ to such an extent as to give any one process a material advantage over the others in competition. Costs of production are gradually falling through increased efficiency and larger output and may be still further reduced. War conditions are for the present exercising an influence in the opposite direction. The use of the electrolytic process, which the commissioners regard as most suited to Ontario conditions, by all the companies operating in Ontario, would not prevent their meeting competition from any other quarter. This process can be operated as cheaply and efficiently in Ontario as in Norway. The Mond Nickel Co. gives its reasons for not refining in Ontario. These are founded on the greater expense due to higher wages, increased cost of fuel and chemicals, higher freight charges and the necessity for quick de-

livery of copper sulphate to Mediterranean ports during the season when it is required.

Some space is devoted in the report to a possible product from the Sudbury ores or slags; namely, nickel-copper steel. There has been a prejudice against the presence of copper in steel, but much recent experimentation has tended to show that this prejudice is unfounded, if the copper is not too high. Indeed, there is reason to believe that the presence of a limited proportion of copper in steel is beneficial and also that it is capable of replacing a proportion of the nickel in nickel-steel up to at least one-third of the combined quantity of nickel and copper. Experiments made for the commission by Professor Guess, of Toronto University, fully confirmed these conclusions. Copper also appears to assist steel in resisting corrosion.

The production of nickel as a byproduct was investigated by the commission. Such production is of considerable importance. Byproduct nickel comes mainly from the electrolytic refining of blister copper, copper ores almost invariably carrying a small proportion of nickel. About 815 tons of nickel was obtained in 1915 from the refining of copper in the United States, and the tremendous production of copper going on in that country will largely increase this quantity. In addition, scrap metal containing nickel is continually being retreated and the nickel recovered. The production of byproduct nickel, though small in comparison with the output of ores worked for that metal, has much bearing upon possible supplies of non-Canadian nickel for export to enemy or other countries.

Precious Metals in Nickel Ores

The commissioners point out that the importance of the precious-metal contents of the Sudbury ores has not in the past been fully recognized. These consist of gold, silver, platinum, palladium, iridium and other rare elements. The proportions of these metals which the ores carry are minute and appear to vary in the several deposits. Roasted matte from one of the companies showed 0.1235 oz. platinum and 0.197 oz. palladium, 0.027 oz. gold and 1.84 oz. silver, while the other company's matte showed platinum, 0.988 oz.; palladium, 0.984 oz.; gold, 0.256 oz., and silver, 6.155 oz. per ton. Platinum is at present very scarce and the price unusually high. Palladium is being substituted for it wherever suited. Both these metals are now worth at least five times as much per ounce as gold. The Orford refining process recovers a much smaller quantity of the precious metals than the Mond and electrolytic processes. The recovery of the metals of the platinum group constitutes an interesting chapter of the report. It states that the platinum and palladium contained in the Copper Cliff mattes for 1916 would be worth $794,600.

Losses in mining, smelting and refining are discussed in the report. These are stated to be considerable. Certain losses are inevitable at each of the successive stages of treating the ore. In mining, heap-roasting, smelting, converting and refining, such losses cannot be wholly avoided. In smelting there is not much reason to anticipate that further saving of the metals can be made. The abolition of heap-roasting would make a small saving in nickel and copper. The whole of the sulphur in the ore must be got rid of, and at present all goes to waste. The question of the possible recovery and utilization of sulphur fumes is given a chapter. Fumes from the roast-heaps are objectionable and injurious, and there is no means of collecting the sulphur given off from the heaps. A million tons of ore contains sulphur enough to make a million tons of sulphuric acid, but sulphuric acid could be produced only at a heavy loss, since the freight charges to markets on so bulky an article would cost more than it is worth.

A chapter is devoted to statistics of nickel production, showing the output of Ontario, New Caledonia, Norway and other countries.

The important subject of taxation is dealt with in the concluding chapter. The commissioners were instructed to report upon a just and equitable system for taxing, not only nickel and copper mines, but mines of all kinds. Their report is that the present method of taxation on net profits is the fairest and best. In their opinion the present rate of 3% should not be raised beyond 5%. Gold-mining companies occupy a unique position; their product has a fixed price of $20.67 per oz., and while all other metals have advanced, some of them very materially, the gold companies get no more for their product than before, yet their costs are largely increased by the higher prices for labor and supplies.

The report seems to cover every conceivable phase of the nickel question, at any rate in relation to industry and trade, and will form a veritable encyclopedia of information for many years to come.

The Recovery of Sulphur from Fume

Sulphide ores are usually wasted before being smelted. The sulphurous-acid fumes resulting are detrimental to agriculture, although not to the extent popularly supposed. Expert investigation carried out by the smelter companies has shown that a general condemnation of neighboring smelter fume as the invariable cause of crop failure is unjustifiable and that the trouble is often traceable to conditions unde the immediate control of the farmer. The damage to soil is, however, generally admitted.

The sulphurous-acid gas may be used for the manufacture of sulphuric acid in localities where a demand exists, and Prof. S. W. Young, of Leland Stanford Jr. University recently presented a paper to the American Institute of Chemical Engineers outlining methods by which the sulphur may be recovered by either a wet or a dry process based on the tendency of the oxygen to leave the sulphur when the sulphurous acid is brought into contact with certain other substances.

Russian Metal Imports

The following statistics of imports, in metric tons, have recently been given out by Russian authorities, according to the *Mining Journal*, Mar. 17, 1917:

Metal	1914	1915	1916
Copper	23,548	10,778	4,576
Lead	23,128	25,059	36,691
Zinc	11,840	14,137	14,328
Tin	2,424	4,906	3,570
Nickel	1,541	1,146	1,793
Aluminum	149	2,316	863
Antimony	3,636	2,325	1,343

Copper and antimony were the only metals that showed an increase over the preceding year. The main portion of the copper came from the United States (11,728 tons) and Japan (8517 tons); the antimony was principally from Japan.

Editorials

America at War

The United States has entered the great war against Germany. It is at last realized in this country that not only were its rights upon the sea assailed in a way to which we could not submit and keep our honor, but also that the cause of liberty in the world is being fought out in Flanders and in France. It is a contest for supremacy between the autocracies and the democracies, and we go to the help of the democracies. It is a fight for principles.

We shall have some arduous things to do. We are not prepared to engage in military tasks. Democracies do not prepare; but we shall learn how and shall do what is needful just as they did in Great Britain and in Canada. We shall have the benefit of their experience. But while we are preparing, we shall be able immediately to give our friends in Europe financial assistance and shall be able to hurry the delivery of supplies to them, while our navy may speedily relieve them of some onerous jobs.

Reluctant as we were to enter the war and regardful of the pains that we must suffer in common with our friends abroad, we must nevertheless rejoice that when the public opinion crystallized it did so swiftly and sharply and showed that the spirit of our forefathers still lived in the Great Republic.

When we finish our new task, we shall be a different people. We shall have learned discipline and the principles of social organization, just as our cousins in England have been learning. We shall have a broader view of affairs, and many things in our life will be changed. But before that we have serious work to do, and at present the thoughts of everybody must be focused on that work. We all want to help, but as yet we have not been told what to do. Probably the authorities themselves do not yet know, but presently the leaders will arise who will tell us. In the meanwhile our word to our readers is to be patient and calm. Avoid being hysterical. Help the families of the men who are called upon to volunteer for the army and navy. And do a lot of thinking.

Financing the War

The plan for financing the war appears to be to do it partly by issue of bonds, partly by large increases in taxes, following the British precedent. The proportion to be provided for in each way depends upon how much is to be charged to future generations, how much to the present. Inasmuch as we are fighting for the benefit of the future as well as for the present, a liberal part of the burden should be deferred.

With respect to taxes, the scientific process will be to make the first levy on wastes and luxuries, for the reason that it will be an economic advantage to restrict both. There should be large increases on alcoholic drinks and on tobacco. For new sources of revenue there may well be taxes on automobiles run for purposes of pleasure—an easy tax to collect—and on motion-picture shows, which are rapidly becoming a demoralizing influence and ought to be curtailed. Duties on tea, coffee, sugar and chewing gum would furnish a great deal of money, easily collected, the burden of which would be widely distributed. Stamp taxes on bank checks, telegrams, Pullman tickets, bills of lading and many legal documents would be a fruitful source of revenue.

Increase in the income tax and the imposition of an excess-profit tax are sure to come. We think, however, that the full measure of them ought to be deferred. For one thing the income tax has just been raised and a large new tax put on corporations; for another thing these are easy taxes to collect and this source of further revenue might well be reserved for emergencies.

The inheritance tax should be left alone, we think. The Federal Government has already encroached upon the preserves of the states in this matter. And, anyway, it is a vicious form of taxation, which eats up capital rather than takes a proportion of income.

The Matter of Prices

The copper producers and steel makers having agreed to supply the Army and Navy with certain quantities of their products at reduced prices, and similar negotiations having been instituted with the producers of lead, zinc and aluminum, the whole matter of prices has become one of great concern. Pending further knowledge as to policies the markets have practically halted. Questions that are asked are How much of the metals is the United States Government going to require? Will it be expected that the prices now being arranged will continue to rule? Will the Allies be supplied at the same price? What will be the position of domestic consumers? Beneath all of this are involved fundamental questions of economics.

We think the following theorems may be accepted:

1. The prime need at the present time is the largest possible supply of metals and everything else.

2. Anything that would check the inducement to produce would be adverse.

3. Economic laws, and especially the law of supply and demand, prevail now as always. Any violation of these laws will inevitably produce evil results.

4. State regulation of prices may not safely go any further than to preclude speculative and panicky inflation. For example, European nations have boosted prices by bidding against each other; individuals of the same nation have done the same. This has been ameliorated by collective buying. However, the price paid has had to be high enough to insure the production of what was required. The state has the power to commandeer production, but if having done so it should operate less efficiently than the private owner it would suffer loss. Those producers who offer to *give* their products to the government exhibit patriotic sentiments, but not good ideas of economics, for if they did so they would soon be bankrupt, unable to give at all, and the nation would suffer from lack of material. If there is to be *giving*, it

must be by everybody and of everything—labor included—but that is manifestly impracticable. Practically the necessities and equalization thereof are adjusted, or should be, by taxation.

We are of the opinion, therefore, that the exhibition of self-sacrifice that was instituted by the copper producers is not to be regarded so much as the establishment of a new social principle as it is as a symbol of commercial disinterestedness; and not so much as a precedent as a starting point for future negotiations that must recognize economic laws. If economic laws be disregarded the seeds of trouble will be sowed that will plague us later.

Belgian Relief

The suggestion has been made by the *Engineering News-Record,* and also by some well-known persons, that a very effective manner of extending financial assistance to Great Britain and France, without offending their susceptibilities, would be to relieve them of the burden of supporting the people of Belgium and the portion of northern France that is occupied by the Germans. The suggestion has even been made that we assume the expenditure on this account since the beginning. Thus, without offering to give anything directly to Great Britain and France, which might offend their pride, we should free their own resources to an equivalent amount.

Incidentally, we should make good in the rôle of saviour of the Belgian people, for which they erroneously give us all the credit, and we should crown the work of Mr. Hoover. In his last visit to this country Hoover strove for increased subscriptions, but the sums that he wanted were too colossal to be raised by private enterprise, no matter how well directed and organized. Such a project could be undertaken successfully only by the nation. We now have the chance.

Daylight Saving

At the last session of Congress, Mr. Borland introduced a bill for daylight saving. It was scientific and simple. The main provision was that at 2 a.m. of the last Sunday of April in each year the clock should be moved back one hour and at 2 a.m. of the last Sunday of September it should be moved forward again, so as to correspond with the astronomical time of the middle meridian of each time zone. This innovation is no more radical than was the fixing of arbitrary times when the system of zones and standard times was instituted many years ago; for as it is now, no place has true time except those that are on the middle meridian.

The effect of the change that is now proposed would be to give us one hour more of daylight in the afternoon, which would be gained at the expense of the daylight in the morning while we are sleeping. Quitting work at 5 p.m., as now, the position of the sun in the sky would be as it is at 4 p.m., and on June 21 there would be four hours of daylight left instead of three.

A special effort is now being made to have a similar bill introduced and passed along with other preparedness measures. Physical training is necessarily the basis of all military preparedness. The young men need more time for recreation and excercise, especially those of the cities. But there are other arguments even more weighty. Many men who do not limit themselves to eight hours of work per day will be able to do more. The expense of one hour's illumination at night will be saved.

This scheme of daylight saving is being adopted in Europe. We think it ought to be in this country, where our summer days are shorter anyway.

Phelps, Dodge & Co.

There was recently a reorganization in a famous old business, whereby Phelps, Dodge & Co. became the Phelps Dodge Corporation and the Copper Queen company became the operating concern. This was purely for internal purposes, there being no change, otherwise, in the business. We are sorry to see the name of Phelps, Dodge & Co. disappear. We have always liked the perpetuation of those old partnership names, when it became necessary to incorporate; best if nothing were added, although the appendix "Limited," or "Incorporated" detracted but little from the flavor. Thus, Witherbee, Sherman & Co., Williams, Harvey & Co., and the like. Phelps Dodge Corporation is not so sentimental as Phelps, Dodge & Co., but there is some law we believe that prevents a reincorporation from taking the same name. Anyway, the perpetuation and glorification of Copper Queen carries on the tradition in this business.

Speaking of names, what a pity it is that a great mine like the United Verde Extension has to figure under a borrowed and confusing title. It is one of the few "extensions" that have ever made good. However, with the naming of mining claims such a strain on the imagination as is the naming of Pullman cars, it is gratifying that our big mines have had dignified titles so generally as they have.

Most of the copper producers put their export business on the basis of f.o.b. New York as far back as a year ago, some of them having instituted the custom earlier, but the Calumet & Hecla company continued to sell on the c.i.f. basis (cost, freight and insurance) in deference, apparently, to its long-established foreign trade. In selling on that basis, the seller takes the chance of getting freight, insurance, etc., upon an estimated, satisfactory basis. Such contracts have been very seriously affected by the recent increases in freights and insurance. On certain shipments these have come to approximately 7c. per lb. Probably the entire copper export business of the United States will soon have been placed on the basis of cents per pound f.o.b. New York, which is what producers in general have long desired.

An esteemed friend of the *Journal,* who contributes occasionally, writes us that when somebody's article is published in the *Journal* that is only the beginning of his troubles. Our friend's last article, a description of an underground station, was published in 1915, and he says that he has not yet heard the last of it, being in receipt of an inquiry concerning it as late as March, 1917.

But he adds: "However, I think that this is one of the advantages of writing for the *Journal.* It increases one's acquaintance." That is just one of the things that it does and it is advantageous, but there are other things of superior importance. First of all is the duty that professional men owe to their profession and their country; namely, the adding to the stock of knowledge and record of experience for the common good.

Up to Wednesday morning the subscriptions to the Belgian Kiddies amounted to $83,636.

BY THE WAY

Peerless John

By D. E. Charlton*

Did'st ever 'ear of Peerless John
And 'ow ee got 'is name?
I tell ee, lad, there never were
A man deserved more fame.

Oh, dam-me, son, them were the days.
We'll see 'em now no more,
For then we worked, Lord 'Arry, 'ow
We worked to get they ore!

We 'ad no hair drills then, m' son,
'Twas single-jackin', too—
Ten-'our shifts—but putten in,
That we was boun' to do.

Tom Kevern, me an' Dickie Broad
Had contrac' four-sixteen.
Old Tom since died, but Cap'n Dick
Ee's super at the Green.

We 'ad 'ad our bit o' paasty,
An' we'd 'ad a drop o' tea,
Were sittin' down an' takin' five—
Just as now, with you an' me.

When of a sudden came a crash.
I want to tell ee, son,
I've 'ad some frights, but this 'ere time
Beats ev'ry other one.

'Ole bloody stope 'ad fallen down,
It seemed at first to me.
But soon I foun' that Dick an' Tom
Were soun' as soun' could be.

I've 'erd of miracles been done,
But never did I see
Just 'ow that stope when comin' down
Missed Dick an' Tom an' me.

But there we were, 'eld 'ard an' fas'—
A room jus' two sets square.
It makes a man do thinkin', son,
An' ask if ee's played square.

For two 'ole days an' two 'ole nights
The boys kep' diggin' spry
To get us out—they nawed that we
Were there, they 'erd us cry.

It seemed no use; the more they dug
The more kep' comin' down.
So Super said: "Run in a pipe,
We'll feed 'em. Damn this groun'."

So in she comes, an' dam-me, lad,
It's 'ard for me to say
Jus' 'ow that pipe haffected us,
But we was glad that day.

An' thru' the pipe come food an' drink,
Enuff to feed a score—
An' dam-me, lad, you would 'a thot
We'd never heat before.

Then Super John shouts in to us,
"Dost care for many more?"
"Oh, thank ee, no—unless thee's got
Some Peerless—ussell's sore."[1]

It 'ardly seemed no time at all
Befor' that Peerless come;
Five poun's there were; I tell ee, we
Was glad, but mos' struck dumb.

Becos at first we figgered out
That we'd be there some time.
But when we stopped to think a bit,
We nawed that wer'n't the line.

For 'ow was Super John to naw
'Ow much a man could chew?
Ee didn't naw—ee'd never tried—
But what was right, ee'd do.

Ee wanted us to 'ave the best.
We did—an' it's no con
That no one calls 'im Super now,
E's nawn as Peerless John.

*P. O. Box 2, Virginia, Minn.

[1]Ussell's sore—sore throat.

The successful manner in which some mining-company reports conceal the nature and situation of the mines is remarkable, and perhaps accounts for the usual ignorance of shareholders as to the property. Shareholders rarely see any general summary of the company's holdings, the situation or depth of the mines, and often where the character of a property has changed, do not know just what metals are being produced. The annual report may give a mass of detail about the current year's operation, but frequently it fails to mention the head office of the company, the place at which operations are conducted and the metal or metals that are being produced. How is the stockholder, who sees this report once a year, to keep these general facts in mind? And suppose anyone inherits some mining stock, what enlightenment would he get from 90% of the mining-company reports? Why not put the inside front cover to some good use?

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

of Engineering and Mining Journal, published weekly at New York, N. Y., for April 1, 1917.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and County aforesaid, personally appeared Chester W. Dibble, who, having been duly sworn according to law, deposes and says that he is the Assistant General Manager of the McGraw-Hill Publishing Co., Inc., Publishers of Engineering and Mining Journal, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business manager are:

Publisher, McGraw-Hill Publishing Company, Inc., 10th Ave. at 36th St., New York, N. Y.

Editor, Walter Renton Ingalls, 10th Ave. at 36th St., New York, N. Y.

Managing Editor, Percy E. Barbour, 10th Ave. at 36th St., York, N. Y.

Business Manager, Lee E. Ives, 10th Ave. at 36th St., New York, N. Y.

2. That the owners are:

McGraw-Hill Publishing Company, Inc., 10th Ave. at 36th St., New York, N. Y.

Owners of 1% or more of Stock Issued:

James H. McGraw, 239 W. 39th St., New York, N. Y.
Arthur J. Baldwin, 10th Ave. at 36th St., New York, N. Y.
Edward J. Mehren, 239 W. 39th St., New York, N. Y.
Fred R. Low, 10th Ave. at 36th St., New York, N. Y.
Fred S. Weatherby, 1600 Beacon St., Brookline, Mass.

3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages or other securities are: Bondholders, James H. McGraw, Arthur J. Baldwin, Henry W. Blake, Imogene Whittlesey, Hugh M. Wilson, Fred R. Low, Fred S. Weatherby, John McGhie, G. Eugene Sly, Estate of John A. Hill.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by him.

CHESTER W. DIBBLE,
Assistant General Manager, McGraw-Hill Publishing Co., Inc.

Sworn to and subscribed before me, this 31st day of March, 1917.

[Seal.] PHILIP S. HILL.

(My commission expires March 30, 1918.)

Personals

D. C. Jackling was in New York last week.

George F. Bridger has gone to Baguio, Philippine Islands.

John T. Fuller, of Morrisdale, Penn., is at Para, Brazil.

Donald F. Irwin has left California for Antofagasta, Chile.

Kirby Thomas has been in Brazil but is expected in New York soon.

H. R. Dorrington has returned to England from the Republic of Colombia.

C. Tazewell, Assoc. Inst. M. M., has returned to England from South Africa.

J. T. Warne is returning to England from the Gold Coast Colony, on leave.

Edwin W. Mills was in Honk Kong on Mar. 6, en route for Shanghai and Peking.

George Kingdon has been made superintendent at the United Verde Extension mines, Ariz.

Milton A. Allen, is now engaged in the New York office of Messrs. Arthur L. Pearse & Co.

W. L. Saunders has been elected a member of the board of the New York and Honduras Rosario Mining Co.

G. Gordon Thomas is now assistant general manager of the Anglo-Continental Mines Co., Ltd., Northern Nigeria.

M. J. West, of Hibbing, Minn., has been placed in charge of all mines of the Oliver Iron Mining Co. on the eastern Mesabi.

D. R. Thomas has resigned as manager for the Davidson Gold Mines, Ltd., at Porcupine, Ont., and is temporarily in New York.

Dr. L. D. Ricketts is making good progress toward recovery, but is still confined to the house and is not able to receive visitors.

W. Donklin, Jr., Inst. M. M., having been discharged as unfit after Active Service in East Africa, is now in Southern Rhodesia.

Arthur S. Dwight has been designated one of the majors of the Engineers Volunteer regiment now being organized in New York.

Dr. E. A. Smith, of Westmoreland, has been appointed Minister of Lands and Mines in the new liberal government of New Brunswick.

M. G. Godfrey, of Virginia, Minn., has been made general superintendent of the mines of the Oliver Iron Mining Co. on the western Mesabi.

Justice Grugan has been appointed consulting engineer to the Grasselli Chemical Co. and is directing some of their diamond-drill explorations.

H. C. Bayldon has been appointed general manager of the Spassky Copper properties at Atbasar and Spassky, and his headquarters are now at Atbasar.

Rastus S. Ransom, sailed on Apr. 11, for Vigo, Spain, on his way to Visen, Portugal, to institute construction work for the Dias Mining Corporation.

Bernard de Ullrick, who has lately been at Quilchena, B. C., installing a mill for the Donohue Mines Corporation, has left for France to rejoin the army.

Dr. Charles H. Henry, editor of the "Journal of Industrial and Engineering Chemistry," has been elected chairman of the New York Section of the American Chemical Society.

Frederick W. Foote, late of the editorial staff of the "Engineering and Mining Journal," sailed on the S. S. Alfonso XII on Apr. 11, for Vigo, Spain, en route for Visen, Portugal, where he will be connected with the Dias Mining Corporation.

Obituary

George Christian Hoffmann, formerly assistant director, chemist, and mineralogist of the Geological Survey of Canada, died in Ottawa, Mar. 8, 1917. He was born June 7, 1837, in London, England, and studied at the Royal School of Mines under Sir Henry de la Bèche, under Hoffman, Percy, Smyth, Stokes, Ramsay, Huxley and Willis. He spent several years as chemist in research laboratories of England, and later 1861, wrought in Natal, South Africa, in the Mauritius, later again in Australia. In 1872 he joined the technical staff of the Geological Survey of Canada, Montreal under Dr. Alfred R. C. Selwyn. Dr. Hoffman was a Fellow of the Institute of Chemistry of Great Britain, Fellow of the Royal Society of Canada and of many other distinguished bodies. His bibliography contains valuable reports and papers of analyses and determinations of Canadian ores, minerals and economic products characterizing the rock formations of Canada and elsewhere, including rare and new species.

Societies

Montana Society of Engineers will hold its annual meeting Apr. 12, 13 and 14, at the home of A. W. Richter, in Butte.

Institution of Mining and Metallurgy—The Twenty-sixth Annual General Meeting will be held, by permission, at the rooms of the Geological Society, Burlington House, Piccadilly, W., on Thursday, Apr. 19, 1917.

Rensselaer Polytechnic Institute—A large number of our graduates have already made application to the Chief of Engineers of the army, offering their services. Arrangements have been to take a census of graduates, as this may possibly be useful in order to enable us to give information to the Government, should such be desired.

College of the City of New York—Five hundred young men are now taking a military course during the daytime, consisting of five hours a week of practical training, chiefly drill, and three hours a week of theoretical instruction. Thirty young men in our evening session wish this course to be repeated after business hours, and this will be done if the course obtains an additional enrollment of about 60.

Texas State School of Mines and Metallurgy—The legislature has appropriated $100,000 for new buildings to replace the one lost by fire in October. A new site of over 20 acres has been donated to the school which will put the buildings in a more accessible place, and close to the El Paso smelting works. The above together with the appropriation for maintenance which is pending, should make this one of the strongest institutions in the Southwest.

University of Pennsylvania—About 1500 students and 125 members of the faculty are engaged in drilling and intensively studying the minor field and drill regulations. There also is a large aviation corps started and will receive three machines in a very short time. They are also organizing a machine-gun company. The National Research Council has been organized with a committee at Pennsylvania, and already certain research work at the request of the Government is going on.

Society of Chemical Industry, New York Section, held a meeting, in connection with the American Chemical Society, at 50 E. 41st St., on Apr. 13. The papers included one on "Recent Advances in Leather Manufacture," by Allen Rogers; another on "Some Technological Aspects of Colloid and Emulsion Chemistry," by Martin H. Fischer, and one on "Ultra-Microscopic Demonstration of Zsigmondy-Brownian Motion," by Jerome Alexander. The meeting was preceded by an informal dinner at the chemist's club.

Lehigh University—Lehigh University was one of the first institutions to respond to the call made by the War Department, through Major-General Wood when Chief of Staff, in the spring of 1913, to coöperate in the establishment of the summer military-training camps, which have proved to be so valuable an adjunct to education and so potent a force in training a body of educated young men for readiness for military service, if needed.

It is believed that the five weeks' intensive training received in these camps is of greater value than any desultory course of training scattered through the year, and we have encouraged our students to take it. There is under consideration the supplementing the military-training camps with some measure of military instruction, by way of lectures and reading under the direction of the War Department, and voluntary drill is now being pursued in our department of physical education.

Worcester Polytechnic Institute—The Worcester Polytechnic Institute has felt that the best preparation of its young men for service in case of war is to make sure of their thorough training in the manufacturing and other engineering duty that they would be called upon to do. It has been thought that purely military training without taking into consideration the special field that this school fills would lead to the same mistake that was made in England when many of the skilled mechanics and engineers were sent to the front.

Last fall, considerable attention was paid to organizing the work in the gymnasium in the direction of the exercises serving as preliminary to military drill and to organizing more effectively the Rifle Club already existing here. There are six target ranges in the gymnasium, where there is a great deal of practice.

This spring, the faculty has voted to permit students to devote some time to special preparation in subjects to which our attention has been called by the War Department. It is proposed to take time from the prescribed studies, in that way recognizing the emergency, by changing the requirements for the class that is to graduate in June. There will be some lectures from army officers, intended to inform students more fully about the places for which they can volunteer in case of war. There are already openings for the bulk of the graduates, and these openings are of such a nature in connection with manufacturing for an army that the students ought not to go into the regular line.

Columbia University—President Nicholas Murray Butler will recommend to the trustees that officers of instruction who are members of the permanent staff and who volunteer or are called upon for public service be protected from loss of income, so far as the resources of the university will permit. Leave of absence will of course always be granted to any officer of instruction who enters the public service.

The president will recommend to the several faculties that all undergraduate and professional students who are in good standing on Apr. 2, 1917, and who wish or are required to withdraw from the university for public service be regarded as having satisfactorily completed the entire work of the academic year and be graduated or promoted accordingly.

A course in training for motor-boat patrol work is now being given in the engineering departments to 138 students.

The Committee or Instruction of the Faculty of Applied Science has also arranged for the substitution of work in military perparation for some of the regular courses for the men who remain here until the end of the term. Of the instructing staff in the Schools of Mines, Engineering and Chemistry, a large number of men are enrolled for the Reserve Engineering Corps, and several of them are already being utilized by the Government for consultation work.

A general university organization is very active just now in providing for an Officers Training Corps and in offering opportunities for military instruction for both students and alumni.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Alkali Metals—Process of Producing the Bicarbonate of an Alkali or Alkaline-Earth Metal. John E. Bucher, Coventry, R. I., assignor to Nitrogen Products Co., Providence, R. I. (U. S. No. 1,221,506; Apr. 3, 1917.)

Alloy of Nickel, Cobalt and Zirconium. Hugh S. Cooper, Cleveland, Ohio, assignor to the Cooper Co., Cleveland, Ohio. (U. S. No. 1,221,769; Apr. 3, 1917.)

Amalgamating Apparatus. Charles C. Lane, Los Angeles, Calif. (U. S. No. 1,221,461; Apr. 3, 1917.)

Amalgamator—Gold-Saving Amalgamator. Earl P. Mayhew, San Diego, Calif. (U. S. No. 1,221,347; Apr. 3, 1917.)

Blast Furnace—Apparatus and Method for Producing Metals of Improved Quality. Henry M. Chance, Philadelphia, Penn. (U. S. No. 1,221,139; Apr. 3, 1917.)

Concentrator. Charles Edward Beyer, Mazatlan, Mexico. (U. S. No. 1,221,659; Apr. 3, 1917.)

Conveyor Chain. Alexander M. Sorber, Newell, Penn., assignor to Pittsburgh Coal Washer Co., Pittsburgh, Penn. (U. S. No. 1,221,617; Apr. 3, 1917.)

Crucibles—Method of Making Clay Pots or Crucibles. Halbert K. Hitchcock, Tarentum, Penn. (U. S. No. 1,221,450; Apr. 3, 1917.)

Drill—Rock Machine Drill for Operating with Flushing Water. Robert Meyer, Mülheim-on-the-Ruhr, Germany. (U. S. No. 1,221,469; Apr. 3, 1917.)

Fumes—Method of Separating Certain Constituents from a Gas or Mixture of Gases. Linn Bradley, East Orange, N. J., and Walter August Schmidt, Los Angeles, Calif., assignors to Research Corporation, New York, N. Y. (U. S. No. 1,221,505; Apr. 3, 1917.)

Ingot Molds. Collapsible Core For. John B. Walker, Birmingham, Ala. (U. S. No. 1,221,116; Apr. 3, 1917.)

Ingot Molds. Flask For. John B. Walker, Birmingham, Ala. (U. S. No. 1,221,117; Apr. 3, 1917.)

Mine-Car Door. Emil F. Tubach, Bernice, Penn. (U. S. No. 1,221,112; Apr. 3, 1917.)

Mine-Elevator Cage. Oscar Gilbert Lee and Francis Marion Osborne, Washington, Penn. (U. S. No. 1,221,754; Apr. 3, 1917.)

Mineral Oils—Process of Treating Mineral Oils for Increasing the Yield of Light-Gravity Oils. David T. Day, Washington, D. C. (U. S. No. 1,221,698; Apr. 3, 1917.)

Pulverizing Apparatus. Joe Crites, Chicago, Ill., assignor to Raymond Brothers Impact Pulverizer Co., Chicago, Ill. (U. S. No. 1,221,144; Apr. 3, 1917.)

Zinc—Chemical Primer for Zinc. James H Gravell, Philadelphia, Penn. (U. S. No. 1,221,046; Apr. 3, 1917.)

Zinc—Condenser for Redistilling Spelter. John G. Granberg, Beckemeyer, Ill. (U. S. No. 1,221,045; Apr. 3, 1917.)

Editorial Correspondence

SAN FRANCISCO—Apr. 5

First Double-Stacker Gold Dredge in Yuba Basin district was completed on Apr. 1 and started the following day to haul up to the digging ground about a mile distant from the point of construction. The stacking equipment was designed to reclaim the banks of Yuba River, providing for a channel about 500 ft. wide between the tailing piles on either side. The dredge was built by the Yuba Manufacturing Co. in its Marysville shops for the Yuba Consolidated Gold Fields at Hammonton. The steel hull was built and launched from the same ways occupied by Yuba No. 15 and the machinery installed in the pond dug by No. 15. The dredge was then hauled by its own power and the use of head line and bow and stern lines into the stream left by No. 15. At one point the stream was narrow enough to require some digging by No. 16 in order to make passage. The two dredges will work together in reclaiming the river channel, the double-stacker boat following the single-stacker. The tailing stackers are over 200 ft. long and will deposit the banks of tailings high enough to protect the adjacent low lands from the highest floods occurring in Yuba basin.

BUTTE—Apr. 5

Placer Mining in Helena's Streets is again a familiar sight. Water due to the spring thaws is rushing down Main Street and Broadway, bringing with it sand and gravel from the adjoining hills and gulches, and has deposited in the gutters of these streets several valuable gold nuggets that were first found by newsboys. The find caused considerable excitement and in a short time men were vieing with boys in search for more nuggets and in panning the gravel that had been accumulating in the streets. Several nuggets valued as high as $10 were reported recovered. Main Street is a continuation of the once famous Last Chance Gulch where placer mining was conducted on an extensive scale in the 60's. Old-timers say that Broadway was slighted in placer days and that the entire sand bed under the street is probably rich pay dirt. Prospectors are now trying to trace the pocket which has been heretofore overlooked.

Washoe Works of Anaconda broke all its previous records in the production of copper during the month of March, the production being 27,638,399 lb. The largest previous production in any one month at this smeltery was in October, 1916, when the output reached 27,539,463 lb. These figures apply to new copper alone. In addition, during March there was enough scrap copper recast to bring the total up to 29,183,000 lb. This scrap copper consists largely of the anode tips, which were reshipped from Great Falls to Anaconda to be handled at the Washoe plant while the furnaces at Perth Amboy are being reconstructed. The building program announced last winter is well under way at the Washoe plant. Much time will of necessity elapse before the big new stack and the smoke-treating plant can be completed. Approximately 35,000,000 brick will be required for this work, and these will all be made by the Anaconda company at its own brick plants. Plans are in the drafting rooms for the huge addition that will treat the smoke for the removal of solids by electrification and the work on the details will keep this department busy for some time. The walls for the addition to the acid plant, which will add 50 tons to its daily capacity, are going up rapidly, and should be completed within a couple of weeks; an additional Wedge furnace will be required for this department. A small nitric-acid plant is also to be installed.

DENVER—Apr. 4

Smelting Investigation, provided for in senate bill 64, enacted by the recent legislature, will be undertaken as soon as the governor appoints a mining engineer and a statistican to serve as experts of the commission that will include also Senators Fincher and Candlish and Representatives McDonald, Ardourel and Nagle. It is doubtful that the $15,000 appropriation will accomplish anything worth while

Creede District Expects Revival, if pending negotiations culminate. Gerald Hughes, A. E. Reynolds, I. B. Humphrey, Jr., L. E. Campbell and Henry Hanington are reported back of a merger that will include the Amethyst, Commodore, Batchellor, New York Chance, Volunteer, Creede and Last Chance companies. It is understood that the plan calls for development at new depths—below the Nelson tunnel—in ground presumed to be rich but which could not be reached because of heavy inflows of water. It is proposed to invest a large sum in plants for mining and milling. Finances have been fully provided and no stock will be publicly offered.

Reopening of Outlying Sections of Colorado's proved districts is expected this year and also new activities in many mines that have been neglected since the exhaustion of orebodies that were early discovered and readily extracted. In many cases development was stopped because of the refractory nature of the ores or the then objectionable zinc content. Advances in metallurgy and prevailing attractive prices for metals are responsible for this new interest and it is freely predicted that this state's number of producing mines will be greater for 1917 than for the last 15 years. Instance of such revival is noted a few miles northwest of Leadville in the St. Kevin district, the geology of which is totally different from that close to Leadville. In the early '80s, Thomas Walsh (he of Camp Bird fame) located the Gerald Griffin claim along a vein in the Archean formation of this Sawatch Range. A miner, connected with the enterprise at that time, stated that during the sinking of the discovery shaft the first 100 ft., shipments of silver ore aggregated more than $200,000 gross; at that depth zinc became such a pronounced component of the ore that another shaft was started 700 ft. up the hill and production was made from another rich shoot until the objectionable zone was again encountered. This property was secured a year ago by Lucien Smith of Leadville who has reopened it with most encouraging results, shipments of high-grade ore being made regularly. Smith has secured also the old St. Kevin group in the same locality and has organized a company that is proceeding to operate both mines systematically. Another Leadville case is that of the Ontario in upper Iowa gulch southeast of town. Here the formations are the typical sedimentaries and porphyries of this district. An adit driven along a strong north-south vein in porphyry has, this winter, developed a shoot of high-grade gold-silver ore. Aspen district reports that the old Keystone mine, now under lease, has disclosed an 8-ft. shoot of ore running about 25% lead and 15 oz. silver. While this is not a grade of ore equal to that produced in former activities of this mine, it now promises much. Gold Hill district, Boulder County, comes forward with a sequel to the discovery and working of the first lode gold mine in that region, the Horsfall. The Snow Bound, an old claim, covers the extension of the Horsfall lode and its recent exploitation has produced shipments with settlement returns of 46 to 57 oz. gold and 400 to 800 oz. silver per ton.

SALT LAKE CITY—Apr. 5

New Leaching Plant of the Utah Copper at Garfield, which has been delayed on account of the late arrival of material, is to be pushed so that the plant may be placed in operation early in the summer. Acid for this plant will be furnished by the Garfield Chemical and Manufacturing Company.

Dividends by Utah Mines for the first quarter of 1917 amounted to $7,095,055 as compared with $4,795,475 for the first quarter of 1916; mines making such payments numbered 13 as compared with 11 the year preceding. Names present this year and not present in the 1916 list are: The Daly of Park City—after a long intermission and with a total dividend record of $2,940,000—paying 10c. a share or $15,000; the Dragon Consolidated, making its first payment of 1c. a share or $18,750; the Moscow, paying $22,500; the Utah Apex, $132,050; the Utah Metal and Tunnel, $342,650. The remaining dividend payers in the first quarter were: Gemini, $25,000; Chief Consolidated, $44,200; Iron Blossom, $100,000; Judge Mining and Smelting, $120,000; Silver King Coalition, $187,500; Silver King Consolidated, $103,290; Utah Consolidated, $300,000; Utah Copper, $5,685,715.

WALLACE, IDAHO—Apr. 4

Cœur d'Alene Mine Dividends, during the first quarter of 1917, amounted to $2,749,940. The results do not include the Tamarack & Custer, which was idle during most of the quarter on account of remodeling mill and constructing tramway; the Hunter, which is understood to be operating at a profit now, but for which no figures are available, nor the numerous leasing operations which have grown to be a factor of considerable importance. The dividends in detail were: Bunker Hill & Sullivan, $490,500; Caledonia, $234,450; Federal, $210,000; Hecla, $450,000; Hercules (estimated), $900,000; Interstate-Callahan, $464,990; making a total of $2,749,940 for the first quarter of this year.

Federal Ceases Work in Contested Area, as a result of the restraining order of Judge Dietrich, of the Federal Court at Boise. In the operation of its Morning mine the Federal Mining and Smelting company was restrained from extracting ore from the ground in controversy with the Star Mining Co. except above the 800 level, and was required to render an accurate account of all ore removed and deposit the difference between the amount received from the A. S. and R. smeltery and the amount that would have been received if shipped under the terms of the Hecla mine's contract. The Federal company, however, decided to abandon all work in the controverted ground pending the trial of the case. This will make a big reduction in the output of the Morning mine. As a consequence the Morning mill No. 2, near Wallace, has been closed. This mill was only recently remodeled and enlarged, giving it a capacity of upward of 500 tons per day. It is intimated by the management that development in the mine may soon provide ore to justify starting the mill again, but for the present only the main mill at the mine will be operated. This mill will handle over 1500 tons per day and will be run at full capacity.

To Secure Railroad Up Pine Creek, the Mine Owners' Association of Pine Creek has devoted much time to compiling data showing the present and prospective tonnage available for a railroad and a committee will soon present the figures to President Farrell, of the Oregon, Washington Railroad and Navigation Co., with the expectation that it will induce the company to build a branch into that section, about 10 miles in length. Shipments during the winter, in spite of the long wagon haul, have reached as high as 2400 tons per month from three properties, the Douglas, Highland-Surprise and Constitution, and they are in position to increase their tonnage if transportation is provided. Besides these the reorganized Nabob company, which has been taken over by the Stewart Mining Co., will build a mill this summer and the Northern Light Co. is also planning a mill. With this showing, it is hoped the railroad company will recognize the importance of Pine Creek and build the branch this summer. Proposed line was surveyed last autumn.

SEARCHLIGHT, NEV.—Apr. 1

Searchlight Region is gradually recovering from the boom period, the meritorius properties, such as the Blossom, Searchlight, Duplex, and Quartette being constantly worked by leasers above water level, and in some cases with great profit. High-grade siliceous copper-gold ore is constantly going forward to the Salt Lake smelteries while the lower grades are milled here, the ores being exceedingly free milling in character. Four miles east of Searchlight, the Chief of the Hills Mining Co., has commenced operations on a group of claims, fairly well developed, and are installing two compressors, hoist and gold mill under the direction of Frank Sharps. The Big Casino Mining Co., adjoining the Chief of the Hills on the north, recently completed sinking of the main shaft to 586 ft., and are crosscutting to the vein on the 550-ft. level. The crosscut will tap for the first time the copper-lead-gold ores below permanent water level. A 30-ton testing mill has been erected. H. B. Sharps is superintendent. Eureka group, three miles north of the Big Casino, has reached a depth of 50 ft. on a 4-ft. vein of copper-silver-gold ore. It is owned by J. T. Nagle. The Colossus Copper Co. has been formed by Philadelphia men to take over the Queen Copper group, 25 miles southwest of Searchlight in the New York Mountains near Barnwell, Calif., and the Big Butte group, 50 miles south of Searchlight, near Needles, Calif. The Queen-Copper development shows from 6 ft. to 10 ft. of smelting copper ore, suggesting installation of smelting plant at Needles. Such a plant would supply a long-felt want for a radius of 150 miles, resulting in a saving on freight on average Searchlight ores of more than $6 per ton. In Eldorado Canyon, 20 miles north of Searchlight, the Techatticup mine and the Colorado-Nevada property are contemplating installing the flotation process in lieu of cyanidation now in use, because of the exorbitant price of cyanide.

VIRGINIA, MINN.—Apr. 5

Strike Vote at I. W. W. Meeting was taken here on Apr. 1 by delegates from the neighboring iron ranges. It was voted to go out on strike if Congress should declare war, but it is not believed that the threat will be carried out. The strike was to be called for May 1. The mining companies are of the opinion that the

Government will not permit the iron-ore industry to be interferred with and that agitators will promptly be taken in hand if they cause trouble. All of the iron ore that the mines can ship will be needed.

ISHPEMING, MICH.—Apr. 6

Advance in Wages, amounting to 10%, was announced by the Oliver Iron Mining Co., Cleveland-Cliffs Iron Co., Republic Iron and Steel Co. and some of the other operating companies. The increase will become effective on the first of May. This is the fourth advance of 10% to be granted since the first of 1916. All advances have been made voluntarily. The managements state that the increases have been made because of the high living costs. The minimum wage for miners on the Marquette range is now about $3.80; trammers and muckers are getting slightly less than this figure. The wages now being paid are the highest in the history of the district.

JOPLIN—Apr. 7

Armed Guards for Mines has followed advent of war in this district. Armed guards have been placed over all the producing properties of the Commerce Mining and Royalty Co.'s mines in Oklahoma, and presumably will be placed over most of the larger mines of the district. Flags are kept flying at the highest points of most of the mills. If many soldiers are called, it will create an acute labor shortage here so far as workers in the mines are concerned, there being already a shortage in the older camps of the district. This is the result of more properties in the producing class, however, as proved by the production records. For the first quarter of 1917 the output of blende was approximately 16,000 tons greater than in the same period of any previous year in the district's history.

WASHINGTON—Apr. 9

Protection of Sulphur Mines arranged. Sulphur supplies for this country and for the Allies are obtained almost entirely from the wells in southern Louisiana and eastern Texas. Since this sulphur-bearing area is near the Gulf seaboard not far from the Mexican coast, the War Department is considering special plans for its defense. Due to the immense importance of sulphur in the munitions industry and in many other lines of manufacture, which are essential to the conduct of the war, all sources of sulphur are being investigated. The Geological Survey is making an investigation of the status of pyrite mining. If shipping should become so scarce as to preclude imports of pyrite, it is believed a considerable proportion of the deficiency can be made up by local production. Phillip S. Smith, the administrative geologist of the U. S. Geological Survey, is in the field at present investigating abandoned pyrite mines. He also will look into the possibility of securing sulphur as a by-product in the treatment of gold, copper and other ores. Protection of mining properties throughout the United States is being carefully considered; preliminary steps in most instances are being taken by the individual operators.

NACOZARI, SON.—Apr. 1

Active Sonora Mines include the Archipelago near Cumpas, operated under lease by Henry Bollweg and associates of Douglas, Ariz.; Belen mine in Las Cabezas section is producing and when the 30-mi. mountain road from Cumpas is completed motor trucks with trailers will be used to haul the ore to Nacozari. The road to the Washington mine, in the district of Arizpe, from the town of Huepac has been completed and machinery for deeper development is being taken to the mine. Operations have been recommenced at the Guerigito mine near Nacozari. A flotation plant is to be erected by the Nacozari Consolidated Mines Co. near Nacozari. Production from the Promontorio mine, east of Moctezuma, is being continued; a motor truck is being tried for transporting the ore to Nacozari. The Chispas mine, of the Minas Pedrazzini Co., near Arizpe, is again in operation after a long shutdown, the ore being shipped to Nacozari. Operations have been started on a small scale at the Lampazos below Moctezuma. The Lily mine, near Nacozari, will resume this month under the direction of J. P. Harvey. Exploration continues at the Caridad, near Nacozari, and about 40 men are said to be at work on the Canario adjoining the Caridad.

TORONTO—Apr. 6

Mining Tax Bill was passed by the Ontario Legislature on Apr. 5, after being re-drafted and considerably modified as a result of strong protests by those interested in gold and silver mines. As finally adopted it leaves all mining companies, with the exception of nickel and nickel-copper companies, practically unaffected, while its provisions as regards the estimating of the value of the nickel output are made clearer and more stringent. As the measure now stands the tax on nickel mines is fixed at 5% on profits from $10,000 to $5,000,000, with an increased rate of 1% on each $5,000,000 profit above the first $5,000,000. The tax on all other mines, is as at present, 3% on excess of annual profits above $10,000 to $1,000,000; profits over that amount to be taxed on the same progressive scale of 1% on each $5,000,000 as applies to the nickel companies. The tax on nickel companies is retroactive as from Jan. 1, 1915. Clauses to which much importance is attached provide that the mine assessor shall ascertain the market value of the fine metal or other product suitable for direct use in industries or arts without further treatment. He shall deduct from this the actual cost of marketing and of each process of refining or treatment as established to his satisfaction by the owner, manager or operator of the mine, and also make further allowances for depreciation, Canadian taxes, etc., the balance to be taken as the annual profits. To prevent a subsidiary corporation putting a nominal value on its ore in dealing with its principal (as it claimed that the Canadian Copper Co. has done) it is further provided that a sale shall not be deemed a bona fide sale where it is made directly or indirectly by an incorporated company to another incorporated company which is associated with or ancillary to the selling company, or which controls or substantially controls the price to be paid to the selling company for the output of the mine. The acreage tax on mining lands was fixed at 5c. per acre.

JOHANNESBURG—Mar. 2

Increased Cost of Mine Supplies is shown in a tabulation in the annual report of the Consolidated Gold Fields of South Africa. The figures given show an approximate doubling of cost of most supplies but there is a striking difference from reported American prices for cyanide. Indeed this material shows less advance over pre-war prices than any other item. The pre-war prices follow (with the 1916 prices in parentheses); Cyanide, 10½d. (11¾d.) per lb.; mercury, £8 10s. (£17 10s.) per flask; zinc, 3½d. (12d.) per lb.; candles, 4½d. (8¾d.) per lb.; carbide, 22s. (45s.) per drum; shoes and dies, 18s. (31s. 6d.) per cwt.; steel plates, 15s. (30s.) per cwt.; rails, £9 10s. (£18 10s.); drill steel, 3½d. (7d.) per pound.

Accident Rate in Rand Mines per 1000 men employed was 3.20 in 1916; 3.58 in 1915; 3.85 in 1914 and 4.70 in 1913; deaths from disease for the same years respectively were 15.55, 14.99, 16.09 and 25.08. This shows a gratifying improvement due to the study of diseases like pneumonia and to better observance of mining regulations and to the educative safety-first work carried on by means of journals, posters and cinema films by the Rand Mutual Assurance. Since 1912 the expense of compensation for miners' phthisis by the government and the companies has cost 4.15d. (8.3c.) per ton crushed and 2.33d. (4.7c.) per ton has been spent for underground sanitation.

The Mining News

ALABAMA

WOODWARD IRON CO. (Woodward)—Preparing to open new red-ore mine on south side of Red Mountain, near Morgan, on the A. B. & A. R.R. Vertical shaft will be sunk.

OTTO COKING CO (Woodward)—This New York company is erecting 60 byproduct coke ovens, making 200 of the new type installed. New ovens will be in operation in September.

ALASKA

KENNECOTT (Kennecott)—Output from Alaskan properties in March was 7,076,000 lb., copper, comparing with 7,090,000 lb. in February.

ALASKA GASTINEAU (Juneau)—In March milled 217,700 tons; heads, $1.09; tails 18.7c. extraction 82.91%. In February, milled 150,000 tons averaging $1.35; in January 173,300 tons averaging $1.24.

ARIZONA

Cochise County

CALUMET & ARIZONA (Douglas)—In March, smeltery output was 8,586,000 lb. of blister copper; C. & A. mines produced 5,528,000 lb.

EL COBRE MINING CO. (Bowie)—New incorporation to develop 21 claims on eastern extension of Willie Rose copper mine. W. E. Powers, president; J. W. Sterling, manager.

SHATTUCK ARIZONA (Bisbee)—March output: Copper, 1,518,436 lb.; lead, 278,778 lb.; silver, 18,176 oz.; gold, 199.47 oz. First quarter: Copper, 4,336,592 lb.; lead, 1,063,901 lb. In cave on 100-ft. level, high-grade ore lines west and north walls; some of the ore runs over 40% copper; cave is 120 ft. long and about 40 ft. wide.

Gila County

MIAMI (Miami)—Copper production in March was 5,217,900 lb., a record output.

OLD DOMINION (Globe)—March copper production 3,335,000 lb.; same month, last year, 3,277,000 lb.

INSPIRATION (Miami)—March copper output 11,100,000 lb.; for first quarter, 32,950,000 lb.

Greenlee County

SHANNON (Clifton)—March copper output estimated at 950,000 lb., comparing with 880,000 lb. in February and 682,000 lb. in March, 1916.

Mohave County

ELKHART (Chloride)—Fourth carload recently shipped; mine unwatered to 500-ft. level.

TENNESSEE (Chloride)—Crosscut on 1600 level, from 1400-1600 winze, encountered 4-ft. orebody; contains less zinc than usual but more lead.

KEYSTONE (Chloride)—Trial run will soon be made of 250-ton mill built under contract by John D. Fields. All mining as yet is being done from old 300-ft. shaft, which has been connected with new mill by 500-ft. incline operated by rope from hoist on new shaft. Fred W. Sherman, formerly at the Daly West in Park City, Utah, is superintendent.

UNITED EASTERN (Oatman)—Reported to be negotiating for Big Jim Gold Mining Co.'s Big Jim and Monarch claims, embracing 2800 ft. along strike of vein and containing all the Big Jim workings. Only property not considered is a fractional wedge northwest of Big Jim claim and north of the Aztec of the Tom Reed company. It is assumed that the 300,000 shares in the United Eastern treasury will be exchanged for the property, equivalent to about $1.35 for Big Jim stock.

Santa Cruz County

TWO STATES (Amadoville)—Ore showing, 12 ft. wide, struck by upper tunnel giving depth of 200 ft., will be further explored by a 1500-ft. tunnel giving backs of 1000 ft. New air equipment ordered to drive tunnel. W. J. Walker, in charge.

WANDERING JEW (Alto)—Being developed for milling ore; several cars of high-grade shipped, and several cars of 60% lead concentrates made in 10-ton experimental mill. J. H. Verfurth, formerly of the Wolverine & Arizona at Bisbee, together with Frederick B. Kollburg, of the Copper Queen mill, have planned a 75-ton mill, and are now building road to mine to transport the machinery. Ore above 200-ft. level, tapped by tunnel.

Yavapai County

CALUMET & JEROME (Jerome)—Three-compartment shaft now down 300 ft.

UNITED VERDE EXTENSION (Jerome)—Continuing to ship high-grade ore; some recent cars have averaged over 25%. George Kingdon, superintendent.

GADSDEN COPPER (Jerome)—Electric hoist now installed and three-compartment shaft, sunk about 80 ft. by hand, will be deepened at greater speed. J. K. Hooper, superintendent.

UNITED VERDE (Jerome)—Smelter output, now equivalent to about 6,000,000 lb. monthly, will be increased by present enlargements to 8,000,000 lb. by June and to 10,000,000 lb. by end of year. Company preparing for steam-shovel operations.

Yuma County

PRIDE (Parker)—Gold-copper orebody opened on 125-ft. level.

COBRITA VERDE (Salome)—Shaft, down 85 ft., has encountered stringers of copper sulphides. New equipment ordered. Charles Readall, superintendent.

COBRITA MINES (Salome)—Shaft in 4-ft. copper vein for 16 ft.; after cutting station at 100-ft. level for exploration of vein, sinking will be continued to 500-ft. level.

WENDEN KING MINING CO. (Wenden)—New incorporation to develop Conrad group of 14 claims adjoining Critic and Wenden Copper groups. Fred A. Elliott, of Elliott Engineering Co. of El Paso, Texas, president; Joseph W. Donnelly, superintendent.

CALIFORNIA

Amador County

CENTRAL EUREKA (Sutter Creek)—Drift on 3425 level, continued from a point 15 ft. from shaft, disclosed good vein of ore carrying some free gold. Station will now be opened at 3350 level and drift started. Good ore is also reported 40 ft. below the 2700 level in hanging wall; on 2450 level, $6 ore in the face of east crosscut. February statement shows: Bullion receipts, $4697; 100 tons concentrate, $6800; total, $11,497. Operating costs, $13,819; includes development, tailing reservoir repair and employees compensation insurance, totaling $2007. While report does not show surplus, the improvement in physical condition of mine is encouraging.

Calaveras County

CHROME ORE near Copperopolis being mined and shipped by Clary & Langford.

AT FORTH CROSSING between Angels and San Andreas, decomposed quartz vein, being developed by Charles Johnson, reported to have produced pocket from which $300 was taken in one day.

ANGELS DEEP MINING CO. (Angels Camp)—Reported that John C. Benson, manager, will return soon from New York and that shaft sinking and development will be immediately resumed.

GHOST (Angels Camp)—Reported that machinery is being overhauled. Developed by 1400-ft. shaft. Idle several years, preparatory to reopening.

PLYMOUTH ROCK (Jenny Lind)—Sinking 200 ft. below old tunnel level. Shipping ore held up by winter rains. Power drills will be installed. Thomas M. Lane, superintendent.

Inyo County

REWARD (Independence)—Flotation mill treating 60 tons a day. Old tailing dump will be put through mill.

CALIFORNIA TALC CO. (Darwin)—Shipment made from new mill, running at half capacity. Two 12-animal teams hauling product to Keeler for rail shipment.

STANDARD TUNGSTEN (Bishop)—Compressor being installed at Aëroplane tunnel; driven 250 ft. by hand drilling. Ingersoll-Rand drills and Waugh stopers will be used. Tram track will be extended ½ mile up cañon to property recently purchased of Vonderheide and Everett. Seven prospect shafts sunk.

Kern County

RAND METALS CO. (Glennville)—June Ione tungsten mine, on Slick Rock Creek about midway between Glennville and Kernville; equipped with jaw crusher, two sets of rolls and Wilfley tables, and one 8-hp. and one 18-hp. gas engine; producing concentrate from scheelite in form of crystals in granite heavily impregnated with iron sulphide.

San Bernardino County

ORO BELLE CONSOLIDATED MINES CO. (Hart)—Has succeeded Oro Belle Mines Co.; developing wide low-grade gold vein under direction of Worth B. Andrews, superintendent; Frank W. Royer, of Los Angeles, who has acted in the past for John Hays Hammond and other New York men, is treasurer. Vein about 60 ft. wide on second level; crosscutting on seventh level.

Shasta County

MAMMOTH COPPER MINING (Kennett)—Estimated March output, 2,000,000 lb. blister copper.

DIAMOND COPPER (Coram)—Property, in Flat Creek district, adjoining Stowell mine, reported optioned to C. W. Geddes of Salt Lake City, representing Boston and New York men.

COLORADO

Clear Creek County

WALDORF (Silver Plume)—New mill nearing completion.

CENTRAL COLORADO (Georgetown)—Farragher & Holcombe opened 30-in. vein, assaying 1.5 oz. gold, 30 oz. silver, and 7% lead.

Lake County

MONTHLY OUTPUT of Leadville district is about 75,800 tons produced by 76 mines. There are 115 active properties in the district, employing about 2000 men.

SILVER KING (Leadville)—Drifting from Pendery shaft at 140-ft. level has opened 3-ft. orebody containing lead carbonates and silver chlorides. Leasing company sinking shaft to reach zinc carbonates opened last year by tunnel from northwest slope of Yankee Hill.

San Juan County

KITTIMAC (Silverton)—New oreshoot opened in Isabella vein.

SUNNYSIDE (Eureka)—Sale of this mine and of Gold Prince group to U. S. Smelting, Refining and Mining Exploration Co. announced.

MAYFLOWER (Silverton)—Development continues under Joseph Sullivan, superintendent. Leased to J. H. Slattery and associates.

PRECIOUS METALS (Ironton)—This property in Mill Gulch being developed by Brown Bros. & Co., lessees. Payable lead ore opened recently.

San Miguel County

HIGHLAND MARY MINES CO. (Ophir)—Recent development opened several bodies of milling ore; installation of small flotation plant under advisement. William Parsons, manager.

NEW DOMINION (Telluride)—Developing 4-ft. vein of milling ore, containing 8-in. streak of smelting ore assaying $60 a ton in gold, copper and lead. J. M. Belisle, manager.

TOMBOY (Telluride)—In March, mill ran 29 days; crushed 13,000 tons of ore; yielding in bullion, $26,700, in concentrates shipped, $71,400; expenses, $68,700; profit, $29,400; from other sources, $850.

BLACK BEAR (Pandora)—Winze being sunk on vein near end fourth level. Crew increased recently and mine producing 125 tons a day, which is shipped via wire-rope tramway to Smuggler-Union mill at Pandora. Zinc concentrate shipped to River Smelting and Refining Co. at Florence.

Teller County

UNITED GOLD MINES CO. (Cripple Creek)—Deep development planned in the Wild Horse; Gleason shaft, now 1275 ft., to be sunk an additional 300 ft. and extensive lateral exploration started. Three sets of lessees working on 300-ft. level and above. I. J. Russell, superintendent.

LAST DOLLAR (Cripple Creek)—This old mine on Bull Hill is being reopened by Catherine Gold Mining Co., which has taken 5-year lease and bond. Charles Walden, of Victor, formerly superintendent of Last Dollar, is in charge. Shaft now 1500 ft. deep is to be sunk 200 ft. Lateral exploration is to be undertaken between 600 and 1500 level and some blocks will be leased.

IDAHO

Latah County

MONTANA MORNING (Troy)—A six-drill compressor to be added to increase development at this lead-silver-zinc-copper property. Three veins being developed by tunnels and shaft.

Owyhee County

FEDERAL MINING AND SMELTING (Hailey)—Underground work resumed and mill, which was not damaged by the snowslide, continued experimenting with various proportions of oil and acid, while waiting for mine to resume normal output.

Shoshone County

HIGHLAND-SURPRISE (Kellogg)—Shaft will be sunk 500 ft. from main tunnel level. Large station now being cut and hoist at Stewart mine has been purchased. Large compressor ordered. Mill turning out about 20 tons concentrates per day; output will be increased when additional ore is available from shaft levels.

MARSH (Burke)—Management announces mine now unwatered; large pump submerged on 900 level is handling the water. Estimate 20,000 tons of low-grade lead ore available in old workings and mill will start on this in May. Shaft will be extended 200 ft. below 900, following vein instead of continuing perpendicular. Marsh mill now being used by Hecla under lease, subject to cancellation on month's notice.

MICHIGAN

Copper

MASS (Mass)—Hoisting about 1000 tons of rock per day.

MICHIGAN (Rockland)—Enlargement of shaft to three compartments almost completed; only about 100 ft. more to go. Expect to resume mining about May 1. Mill will be about ready at that time; installing more up-to-date apparatus.

MOHAWK (Mohawk)—Best tonnage for the year in March. Mechanical-rope haulage installed at seventh and eight levels of No. 6 shaft, and electric haulage may be tried. Trammers scarce in this district, making electrical or rope haulage especially advantageous at this time.

Iron

SPIES (Iron River)—Mine now a producer; ore being stocked. Will ship when navigation opens.

ATHENS (Negaunee)—Contract let for six brick mine buildings. Change house will be largest on range; 254 ft. long. Work to start immediately.

CLEVELAND-CLIFFS (Ishpeming)—No. 5 Keystone churn drill put to work in North Lake district. First churn drill to be operated on Marquette Range. Will be used to put casing down into the rock. Diamond drill will then complete hole.

MINNESOTA

Mesabi Range

ST. JAMES (Aurora)—Contract let to strip 1,000,000 cu.yd. of overburden. Property has been worked as underground mine.

SHENANGO (Chisholm)—Drainage shaft is being sunk at bottom of pit, 80 ft. below the ore surface. Electric pumps will be installed.

MAJORCA (Calumet)—Being opened by Pickands, Mather & Co.; stripping being done by Butler Brothers. Adjoins great Hill Annex mine. Over 1,000,000 cu.yd. of overburden will be removed.

YORK (Nashwauk)—Framework for washing plant practically done. Shaft sunk and stripping operations on pit will start with large dragline excavator. Ore will be milled from pit and hoisted through shaft, and conveyed to washery.

WEBB (Hibbing)—Improvements made at washing plant during winter. Pit being developed by Shenango Furnace Co.; stripping is being done by Winston-Dear Co. which is assembling 300-ton Marion shovel for the work.

MISSOURI

Joplin District

C. E. SWARTZ (Tar River, Okla.)—Has two new mills in operation.

CONTINENTAL MINING (Miami, Okla.)—Will build new mill on Hocker land, south of Baxter Springs, Kan. John Bomford, president.

RUBY (Baxter, Kan.)—Good strikes made on tract east of Blue Mound mine. Will drill several more holes; then build mill.

ST. PAUL (Joplin)—Planning to help operators in developing shallow lead and calamine mines on land southeast of Joplin. Will furnish part of equipment.

HARMONY (Picher, Okla.)—Building new 350-ton mill on tract northeast of Picher. B. F. Harmon, president; W. H. Dill, treasurer. Lease thoroughly prospected.

VINEGAR HILL (Baxter Springs, Kan.)—Installing big Pomona pump at site of new mill northeast of Blue Mound mine. Will have pumping capacity of one million gallons daily.

PLAYTER BROS. (Joplin)—Sold Peacock-Galena lease, with mill, at Galena to J. V. Compton and W. O. Porter. Consideration unofficially reported at $30,000. Twenty-nine drill holes on tract.

KEYSTONE TAILINGS CO. (Joplin)—Completing 400-ton tailing mill on Blue Goose tract near Tar River, Okla. T. L. Eyre and J. O. Clark, of Philadelphia, Penn., principal owners. P. B. Butler, Joplin, manager.

NORTHERN ARKANSAS

MARCH SHIPMENTS amounted to 69 cars from the Arkansas field. Biggest producer was J. C. Shepherd's Big Hurricane mine, near Pindall, which shipped 16 cars; 24 cars went out from the Rush-Buffalo camp; 13 from the Zinc camp; 4 from the Cave Creek section; 18 from Pindall; 7 from Ponca; and 3 from Kingdon Springs.

MONTANA

Granite County

OLYMPIA MINING CO. (Princeton)—In tunnel on company's Lillian and Banner Claims, three veins cut carrying galena, silver and gold. One vein reported 20 ft. wide. Extensive development planned this season.

Jefferson County

MONTANA ZINC CO. (Corbin)—Machinery being installed and sinking will soon be started to develop lead-silver orebody.

MONTANA CONSOLIDATED COPPER (Boulder) This company plans expenditure of $100,000 for machinery and prospecting of old Comet mine this season; unwatering mine will take about two months. Mine, old producer, 7 miles northwest of Boulder, has been shut down for 10 years except for activities of leasers, who have been shipping lead, silver and zinc ore to East Helena and Anaconda. Property embraces 650 acres.

Mineral County

TARBOX (Saltese)—Management reports crosscut on 600 level in ore for last 40 ft. carrying ore with about 12% lead. Shaft will be sunk to the 800; planning for mill next summer.

Silver Bow County

EAST BUTTE (Butte)—March copper production 1,597,340 lb., comparing with 1,306,900 in March, last year.

ANACONDA (Butte)—Production of copper at company's Great Falls and Washoe smelteries amounted to 31,300,000 lb. during March as against 25,000,000 in February. Increase for first quarter 1917 over last year was 10,700,000 lb.

NORTH BUTTE (Butte)—Dividend of $1 per share declared, payable Apr. 30. Company reports net profits in 1916 of $2,479,595. Copper production for year, 24,498,181 lb.; silver 1,047,063 oz.; gold 1712 oz. Average number of tons hoisted per day was 1605. Development work during year 21,694 linear feet.

BUTTE & SUPERIOR (Butte)—New electric hoist will be ready for operation by middle of May; capable of hoisting five tons of ore from a depth of 5000 ft. in 1¾ min. March zinc production about 14,400,000 lb. as compared with 13,500,000 in February; milled in March 51,000 tons producing 14,900 tons zinc concentrates averaging nearly 49%; about 300 tons lead concentrates; silver about 300,000 oz.

NEVADA

Esmeralda County

GOLDFIELD CONSOLIDATED (Goldfield)—In February milled 21,000 tons; net realization, $19,-221; operating costs, $5.858 per ton; sundry earnings, $0.113 per ton. Leasers produced 108 tons valued at $2696, from which company received $1531. Company did 1698 ft. of development costing $5.53 per ft.

Humboldt County

IN DISASTER PEAK SECTION, George J. Shoup, of Winnemucca and San Francisco, has bonded several claims of Choate brothers and Elias Jones who have worked oxidized ores from five veins for several years by arrastre. Lessee has installed drills and Chicago Pneumatic NSO compressor and is drifting, raising and sinking.

ROCHESTER MINES CO. (Rochester)—Crosscut on 700-ft. level disclosed high-grade ore, containing native silver, in ground adjacent to Codd winze; good ore also on 600 and 800 levels. Aërial tramway completed to millsite.

WINNEMUCCA MOUNTAIN (Winnemucca)—Crosscutting on 200-ft. level in company's Bonanza mine to catch high-grade silver oreshoot opened in bottom of drift on 100-ft. level; parallels gold vein of this property. John R. Turner, superintendent.

ROCHESTER COMBINED MINES CO. (Rochester)—Besides the five-drill compressor now in operation, a six-drill compressor is being installed and another contemplated. Main working tunnel, 250 ft. below Shepherd No. 1 tunnel, is in about 200 ft.; blacksmith shop and Sullivan drill sharpener installed at mouth. K. Freitag is designing the mill; first unit will treat 300 tons and use ball and tube mills. New townsite to be laid out adjacent to Packard.

Lander County

HIGHLAND MARY (Austin)—Frank McLaughlin and George Gordon, leasing on this property of Nevada Equity Mines Co., recently shipped 20 tons of lead-silver ore from 5-ft. vein; on hanging wall is 6-in. bromyrite ore running high in silver; developing in old Pony vein system. Some auriferous zinc ore taken out.

Mineral County

DISPOZITCH (Mina)—L. B. Spencer, lessee, opened vein of high-grade copper-lead-silver ore from 6 in. to 4 ft. in width; first shipment averaged $60 per ton; next $105. Tunnel and winze give depth of 150 ft.; five men working. Property, about 5 miles west of Rhodes Marsh, the shipping point. Being examined by prospective buyers.

Nye County

TONOPAH ORE PRODUCTION for week ended Mar. 31 was 9012 tons valued at $162,216, comparing with 8920 tons for week previous. Shippers were: Tonopah Belmont, 2937 tons; Tonopah Mining, 1695; Tonopah Extension, 2380; Jim Butler, 800; West End, 659; Rescue, 254; Halifax, 156; Montana, 39; North Star, 54; Cash Boy, 50; Midway, 16, and miscellaneous, 22 tons.

TONOPAH EXTENSION (Tonopah)—February results: Receipts, $121,439; operating expenses, $83,789; operating profits, $37,650.

TONOPAH BELMONT (Tonopah)—In quarter ended Feb. 28, reecipts were $658,076; operating expenses, $349,813; operating profit, $308,262; other income, $8275. Quick assets, $1,256,511.

CASH BOY (Tonopah)—Breaking ore at lowest point in district, equivalent to 1600-ft. level of the Victor mine which has deepest shaft, 1540 ft.

CONSOLIDATED SPANISH BELT SILVER MINING CO. (Tonopah)—This company, recently formed by Ohio men, is developing the old Barcelona mine in northern Nye County, between Manhattan and Belmont. Driving 1200-ft. tunnel to tap several veins 100 ft. below old workings; under direction of W. J. Pike, superintendent of the Jim Butler at Tonopah.

NEW MEXICO

Grant County

CHINO (Hurley)—February copper output, 6,572,106 lb., as compared with 4,617,220 lb. in February, 1916.

CARLISLE (Steeplerock)—Pilot mill operating at capacity, 75 tons daily, on mill heads averaging about 80c. per ton gold, 2 oz. silver, 1.25% copper, 7½% lead, 7% zinc; lead and copper recovery reported excellent; zinc yet to be determined.

OREGON

Josephine County

PARSONS (Merlin)—Short tunnel has disclosed copper ore full width of workings. Shipments will be made as soon as 7-mile wagon road is completed. D. R. Morrison, manager.

LOGAN-SIMMONS (Waldo)—This placer mine being drilled by G. E. Esterly of Seattle. L. A. Levensaler, a Tacoma mining engineer, has made numerous visits to the property, which comprises about 1500 acres. During last season many shafts were sunk. Mine operated by hydraulic elevators; gets water from east branch of the Illinois River, having about 25 miles of ditches and pipe line.

Juab County

TINTIC PRODUCTION FOR MARCH—covering five weeks—amounted to 1042 cars of an estimated tonnage of 52,000 tons, valued at about $1,300,000, as compared to 737 cars in February and 802 cars in January. The number of shippers for the month—31—is above normal for the camp, which has a greater number of individual producers than any other camp in state.

TINTIC STANDARD (Eureka)—Shipped in March 14 cars of ore. Three-compartment shaft down 630 ft.; being driven to develop ore opened at depth; progress during March 180 ft.

Salt Lake County

SHIPMENTS FROM ALTA for third week in March amounted to 32 cars or about 1120 tons, the ore coming from South Hecla, Sells, Emma Consolidated and Cabin.

FORTUNA (Bingham)—Important body of ore reported in process of being opened—so far, 300 ft. along strike and raise up 125 ft. in ore; high-grade along foot wall and remainder milling ore. Ogden interests said to have relinquished option.

CARDIFF (Salt Lake)—This company in Big Cottonwood is again experiencing haulage difficulties; bad roads, following spring thaw, after unusually severe winter. Betterment of conditions not expected before 20 days. Property largest shipper in district. Normal output about 100 tons daily.

UTAH COPPER (Bingham)—Daily tonnage of 30,000 tons being handled, and will be increased as soon as weather conditions allow. Production for February—shorter month by three days—is 13,459,829 lb. as compared with 13,913,811 lb. in January. Heaviest output of any February in history of company. Output for March estimated roughly at over 15,500,000 lb. copper.

BINGHAM METAL AND TUNNEL (Bingham)—Report for 1916 shows gross value of ore mined to have been $1,499,267, and total income $1,535,214; operating expense, $933,383; operating profit, $601,830; net profit, making allowance for depletion charge, taxes, interest, etc., was $528,737. During year there were produced 1,761,520 lb. copper as compared with 2,873,815 in 1915; lead, 6,301,670 lb. as compared with 9,860,089 lb. in 1915; gold, 17,930 oz.; silver, 388,757 oz.

Summit County

PARK CITY SHIPMENTS for March amounted to 7179 tons, this being an increase of 1288 tons over February. Shippers were: Silver King Coalition, 2374 tons; Ontario Silver, 1461 tons; Judge Mining and Smelting, 1452 tons; Silver King Consolidated, 896 tons; Daly West (mill unable to operate owing to frozen water supply), 271 tons; Daly, 263 tons; Naildriver, 134; California-Comstock, 127; Charles Moore, 74; Broadwater Mills, 70; Utah Ore Sampling, 32; Western Ore Purchasing, 25 tons.

SILVER KING CONSOLIDATED (Park City)—Spiro tunnel—being driven to develop Thaynes Canyon section—progressing about 15 ft. daily, working three shifts. In about 2500 ft.; ultimate length, 14,000 ft. Ore-bearing ground expected 1000 to 2000 ft. from present face. Shipping 50 to 60 tons of crude ore daily, and mill treating 50 to 60 tons.

CALIFORNIA-COMSTOCK (Park City)—Shaft to be sunk from 450 level in search of continuation in California-Comstock ground of orebodies trending in that direction from neighboring properties. Property well equipped, accommodations for men, mill, hoist, compressor, etc., on ground; ordered additional transformers, air pipe, machine drills and other tools. Ore left in mine when work was abandoned several years ago, owing to water.

Tooele County

WESTERN UTAH COPPER (Gold Hill)—Shipping about 36 cars of ore (1400 tons) weekly. Ore averages 5% copper; 6 oz. silver; and 20 to 25% iron. Large tonnage developed.

DEEP CREEK RAILROAD—recently completed—is transporting at rate of 5000 tons of ore a month from the new camp of Goodwin (Gold Hill). There is talk of 12-mile branch line from Erickson's ranch into the adjoining Ferber district as soon as enough ore shall have been developed there to warrant it.

WASHINGTON

Ferry County

REPUBLIC SHIPMENTS during a recent week amounted to 590 tons of ore; 240 by Knob Hill company and 350 by Lone Pine-Surprise Consolidated.

BELCHER (Republic)—Resumed operations and Belcher Mountain railway is being put in condition for delivering ore to Lambert station on Great Northern Ry.

LONE PINE-SURPRISE CONSOLIDATED (Republic)—New double-compartment shaft at the Lone Pine down about 700 ft. Station cut at 500-ft. level in Last Chance claim where vein is about 5 ft. wide.

Stevens County

UNITED COPPER MINING (Chewelah)—On 1100-ft. level, a 4-ft. vein of good copper-silver ore was recently opened. Mule tramming from mine to mill, about one mile, superseded by electric haulage.

IROQUOIS MINING (Northport)—In Electric Point district, 16 miles north; has car of high-grade lead-silver ore ready to ship as soon as roads permit; taken from upper tunnel near surface. About 325 ft. lower, another crosscut tunnel is being driven; now in over 200 ft. Compressor lately installed. C. W. Van Horne, of Spokane, president.

CANADA

British Columbia

DONOHUE MINES CORPORATION (Quilchena)—Recently installed 30-ton mill, designed by Bernard de Ulrick of Seattle, to treat complex ores of the Tubal Cain, King William and Joshua mines; ores contain copper, lead, zinc, silver and gold; a "balanced-rod" mill is used for grinding and Monarch concentrators. Joshua and King William mines developed by shaft, that of the former being 400 ft. deep with levels each hundred feet; the Tubal Cain is opened by tunnel, following vein for over 300 ft. Some shipments of crude ore made to Trail smeltery. Frank M. Hawkes, manager; James McKieran, superintendent.

ONTARIO

SILVERADO (Gowganda)—At this property, which shows several good veins, a 100-hp. boiler and other equipment is being installed.

ELLIOT-KIRKLAND (Kirkland Lake)—Main shaft down 80 ft. on vein showing free gold. Crosscut will be run at 125-ft. level to tap vein system coming in from McKane property adjoining. Electric power obtained.

NEWRAY (Porcupine)—Crosscut at 400-ft. level tapped orebody 5 ft. in width, 340 ft. from shaft.

SLADE-FORBES ASBESTOS CO. (Porcupine)—Crude asbestos being shipped to Cincinnati. A ton recently sent was valued at $600.

ADANAC (Cobalt)—Calcite vein 12 in. wide, carrying ruby silver, has been crosscut 210 ft. from shaft.

SYLVANITE (Kirkland Lake)—Veins showing visible gold uncovered on the surface and contract let for sinking shaft 100 ft.

DOME EXTENSION (Porcupine)—Underground workings of the Dome at 700-ft. level have extended into this property and high-grade ore opened.

COLOSSUS (Munro Township)—Contract let for diamond drilling to test surface outcrops at depth.

McKINLEY-DARRAGH (Cobalt)—Second 200-ton flotation plant ordered. Tailings will be reground in Marathon mill, 4 x 8 ft.

CALUMET & MONTANA (Cobalt)—Has crosscut 2-in. vein carrying silver.

HARGRAVES (Cobalt)—Rich ore being taken from winze down 15 ft. from 375-ft. level; now has 115 bags of high-grade ready for shipment.

KIRKLAND LAKE (Kirkland Lake)—Main shaft has reached 550-ft. level; will be sunk to 1000 ft. and orebody tapped every 100 ft.

DOME MINES (South Porcupine)—In March milled 36,700 tons yielding $175,000, as compared with 36,270 tons and $172,500 in February.

MEXICO

GREENE-CANANEA (Cananea, Son.)—March output 5,500,000 lb. copper, comparing with 5,100,000 lb. in February.

ESPERANZA (El Oro, Mex.,)—Milled in February 20,732 tons; profit about $21,850.

SANTA GERTRUDIS (Pachuca, Hidalgo)—Mill idle in February; no cyanide. No milling 500 tons daily.

CHILE

BRADEN (Sewell)—March copper output 5,942,-000 lb., a high record; last year, March production was 5,406,000 lb.

CHILE EXPLORATION (Chuquicamata)—March copper output 8,714,000 lb., a high record, comparing with 6,056,000 lb. in February.

PERU

CERRO DE PASCO (La Fundicion)—March estimated copper production 6,074,000 lb. comparing with 5,352,000 in February and 6,172,000 lb. in January.

SOUTH AFRICA

DIAMOND DISCOVERY near Aliwal North, in the northwestern part of Cape Province, reported by U. S. Consul E. A. Wakefield, of Port Elizabeth. Area containing about 1000 claims was opened for location on Feb. 19.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—March cleanup by cable, $147,705. In February, mills operated steadily, except Tabowie mill which lost two days owing to water shortage; milled 23,885 tons yielding $132,232 in bullion. January final results show net profit of $78,811 from 27,428 tons milled; gross receipts $154,056; operating costs $71,828; operating profits $82,228; put back in improvements and development $3,417.

The Market Report

Metal Markets

SILVER AND STERLING EXCHANGE

Apr.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Apr.	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
5	4.7563	73⅜	36⅛	9	4.7563	73⅜	....
6	4.7563	73⅜	....	10	4.7600	73⅜	36⅛
7	4.7563	73⅜	....	11	4.7575	73¼	36⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Apr.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
	29¼		9	8.80	9¼
5	@30¼	54½	@9½	@9	@10
	29		9	8.80	9¼
6	@30¼	54½	@9½	@9	@ 9½
	28¾		9	8.80	9¼
7	@30¼	54½	@9½	@9	@ 9½
	28¾		9	8.90	9¼
9	@30¼	54½	@9½	@9.10	@ 9½
	28¾		9	9	9¼
10	@30¼	54¾	@9½	@9½	@ 9½
	28¾		9	9	9¼
11	@30¼	55	@9½	@9½	@9½

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes; ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Apr.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
5	136	135½	151	216	216	30½	55
6	....	....	....	....	....	....	....
7	....	....	....	....	....	....	....
9	....	....	....	....	....	....	....
10	136	135½	151	216½	216½	30½	55
11	136	135½	151	216½	216½	30½	55

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

NEW YORK—Apr. 11, 1917

The amount of business transacted in any of the principal metals last week was small, zinc being the most active and also the weakest. Copper was dominated by uncertainty respecting Government price policy, but was weaker in tone. Lead, on the other hand, signalized itself by becoming distinctly stronger.

Copper, Tin, Lead and Zinc

Copper—The dominating influence in this market was uncertainty respecting Governmental action, especially the questions whether the American Government would requisition more copper at 16⅝c., and whether the allied governments would be supplied on the same terms. With these circumstances nobody desired to contract ahead, although there was still some demand for early deliveries. On the other hand, there was a distinct desire in several quarters to sell for third-quarter delivery at sharp concessions in price, on the theory that copper would certainly go no higher, and probably would go lower. The market was very uncertain, and is very difficult to quote. On Apr. 5, 1000 tons of May-June copper was offered in behalf of a consumer who desired to resell and bids of 31½c. were solicited. It was reported that this copper was still in the market as late as Apr. 10. At the close of the week, April copper was quoted at 32c. May-June was probably to be had at 30½@31c. on any firm bid. For third-quarter delivery, 29@30c., r.t., was quoted, there being several sellers at 29c. and some transactions at that price. Copper for August-September delivery was reported offered as low as 28½c., r.t.

Copper Sheets—No change has been reported in the situation as described last week. We continue to quote hot rolled at 42@44c. per lb., cold rolled 1c. per lb. higher. Wire is now quoted 38@40c., f.o.b. mill.

Tin—The permit situation was still a matter of grave concern. Tin did not arrive freely, and buyers not receiving what they expected had to go into the spot market, which caused the latter to be very firm. A fair volume of business was reported.

Lead—Transactions for the week were very much less than in the previous week, producers reporting only a little more than 1000 tons sold. In the latter part of the week, however, an increased volume of inquiries was received, and the market turned very strong again, one of the large producers withdrawing pending further developments. It is believed that consumers have yet considerable covering of April and May requirements to do. A very large order for export was in the market on Apr. 10, but not much stock was taken in it, i.e., it was thought that the quantity talked about would prove much exaggerated when the business was actually placed.

Zinc—In our last report we mentioned that there were signs of pressure to sell in this market, and intimated that early spelter had been held back to cover forward sales. Right from the beginning of this week, pressure was exhibited, not only for April-June delivery, but also for prompt, and no further attempts being made to maintain the fiction of scarcity of supplies, the premium on prompt delivery immediately disappeared and at the end of the week, prompt spelter and April-June contracts were available at practically the same price. Producers and consumers both were sellers, the appearance of consumers as resellers being evidently a reflection of the relaxation in the freight congestion. It is no longer denied that unsold stocks of spelter are accumulating, and it is said in well-informed quarters that only about two-thirds of the April production is sold, about one-half of May and about one-third of June. Beyond June, practically nothing.

Zinc Sheets—Price of zinc sheets has not been changed. Market remains at $21 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Minerals

Antimony—Spot is slightly easier owing to steamship arrivals from the Far East; we quote 34@36c. April-May shipment from China is firm at 14@15c., c.i.f., New York, duty unpaid.

Aluminum—The aluminum market remains in about the same condition as reported last week. No great demand has developed. We report no change from last week's figures. Nominal quotation is 58@60c. per lb. for No. 1 ingots, New York.

Nickel—The market remains steady at 50@55c. per lb. for nickel. Electrolytic commands an additional 5c. per lb.

Quicksilver—At the beginning of the week market was $118@120 and during the week went off to $115, but recovered and today is strong at $120. San Francisco reports by telegraph $115 steady.

Gold, Silver and Platinum

Gold—The Transvaal gold output for February, 1917, was £3,063,974, as compared with £3,324,418 in January. According to Samuel Montagu & Co., London, under date of Mar. 15, the Bank of England gold reserve against its note issue shows a reduction of £343,700, as compared with the returns for the previous week.

Silver—The silver market has been dull and quiet the past week owing to the Easter Holidays. The price in London has remained unchanged at 36⅝ pence and market has no special features; holding steady on demand for coinage. The stock in London has slightly increased and is now about 4,000,000 oz.

According to report of Samuel Montagu & Co., London, under date of Mar. 15, the week has been characterized by sharp retrograde movements of the price. After a recovery of $\frac{5}{16}$ from the quotation fixed a week ago, there has been a daily fall of more or less severity, until 35⅞ was reached today. More than one cause contributed to the weakness of the market; the Shanghai exchange fell considerably, and sales of silver took place from that quarter, encouraging similar operations on the part of the Indian Bazaars, which have now opened a fairly large "bear" position in this market. The holdings of silver in the Indian treasury have increased, partly due to the seasonal influx of coin derived from taxes, though chiefly due to the recent purchases of silver on behalf of the Mint. The combination of these two factors have more than counterbalanced the effect of the usual withdrawals for hoarding purposes.

Mexican dollars, at New York, Apr. 5, 57⅛c.; 6, 56⅞c.; 9, 56¾c.; 10, 56¾c.; 11, 56⅞c.

Platinum—Firm at $102½@105.

Palladium—Unchanged at 90@95.

Zinc and Lead Ore Markets

Platteville, Wis., Apr. 7—Blende, basis 60% Zn, $85 for premium ore down to $80 for medium grade. Lead ore, basis 80% lead, $113 per ton. Shipments for the week are 2851 tons of zinc ore, 107 tons of lead ore, and 695 tons of sulphur ore. For the year to date the figures are: 36,154 tons of zinc ore, 1155 tons of lead ore, and 6340 tons of sulphur ore. Shipped during the week to separating plants, 4013 tons of zinc ore. A large number of foreigners employed in the mines departed for the east during the past week and many mines are short of help.

Joplin, Mo., Apr. 7—Blende, per ton, high, $87.90; basis, 60% Zn, premium ore, $85; medium to low, $84@75. Calamine per ton, basis 40% Zn, $50@45; average selling price, all grades of zinc., $80.68.

Lead, per ton, high, $117.65; basis, 80% Pb, $115@110; average selling price, all grades of lead, $116.09.

Shipments the week: Blende, 9679 tons; calamine, 783 tons; lead, 1835 tons. Value, all ores the week, $1,057,010.

Aside from the greater demand strengthening medium-grade ore prices the market was featureless. Never were spring weather conditions more favorable for production, which is pushing toward 10,000 tons per week, blende and calamine. Shipments have exceeded the production the past four weeks.

Other Ores

Antimony Ore—This ore is very scarce. High-grade ore is quoted nominally at $2.50@2.75 per unit.

Manganese Ore—Furnace ore is quoted at 80@85c. per unit, basis 50% managanese. Chemical ore is quoted at 4½@6c. per lb.

Charles Hardy has been appointed sales agent for the Phelps Dodge Corporation for the sale of the manganese dioxide and furnace ore of its Bunker Hill mines.

Imports of manganese ore into the United states in January, 1917, were 49,530 gross tons, which compares with a monthly average of 48,027 tons in 1916. December, 1916, imports were 16,648 tons.

Molybdenum Ore—Such small supplies as are coming on the market are bought at fancy prices. There is no regular market. Orders for 30 tons of ferromolybdenum were cancelled recently owing to inability to get raw material in time to fill them.

Tungsten Ore—Market very active, over 500 tons being reported sold at $16.50@18, according to quality. We quote $17@18. The latter price would have to be paid for high-grade ore, practically free from impurities.

Charles Hardy, under date of Apr. 10, says the following: "Not only has our market taken prompt and forward delivery, but Europe has again been an active buyer and has still options

for considerable quantities, the options falling due during this week. The New York market is as bare as ever of quantities of high-grade ore, and in view of the increased difficulties in obtaining shipment from South America, it is not likely that the New York market will soon be replenished. At the moment of writing, a meeting of the tungsten producers of the United States is taking place in San Francisco, and the outcome of this meeting is anxiously looked forward to by the trade."

Iron Trade Review

NEW YORK—Apr. 11

Higher prices for pig iron and finished steel, greater scarcity of labor, says "Iron Age," and hence further wage advances, increased demand upon all steel and metal-working capacity to fill enormous orders of the Government—all are indicated by the developments of the first week of the war.

The labor problem is giving no little concern. Workers released by the expiring of foreign munitions contracts are being absorbed by other lines of industry. When later the Government places war orders on a large scale, many of these workers will be drawn back, but meanwhile recruiting will add to the scarcity of shop labor. Costs will increase at the same time that Government orders carry prices far below those secured on the expiring European contracts.

PITTSBURGH—Apr. 10

Steel for the present naval program has been arranged, at 2.90c., for plates and 2.50c. for shapes and bars, against 4.50c. for plates, 3.60c. for shapes and 3.35c. for bars now ruling in the open market for indefinite delivery and higher prices for early delivery. Between 400,000 and 500,000 tons is involved. For other Government activities there will be further requirements, measured probably in hundreds of thousands of tons, while if shell making for the European Allies is undertaken on a large scale, following the recent decrease in the business as conducted by ordinary purchase and sale, there may possibly be required steel at a hundred thousand tons or more a month, the total production of steel at present being at least 2,500,000 tons per month in finished form.

All delivery promises have ceased, not because the steel now sure to be required for Government account is large, but because of uncertainties as to what will be required. Buyers seek to be covered with as much eagerness as formerly, though thereby they merely obtain a place on order books, not a promise as to delivery. The Steel Corporation's unfilled obligations increased by 134,947 tons during March, and as contracts for sheets and tin plates for second half are now being entered April promises to show a larger increase.

Transportation conditions continue to improve slowly and steel shipments have slightly increased, some of the accumulations being moved, while coke supples are almost adequate and pig iron production has risen to a rate of 40,000,000 tons a year, very nearly the physical capacity with a full supply of raw materials. Pig iron has grown scarcer, however, probably because steel making capacity has increased more than blast-furnace capacity.

Pig Iron—The fact reported a week ago that a large merchant producing interest had itself bought basic iron at $35, valley, was suggestive of higher prices in prospect and these have been realized, $38, $39 and $40 have been paid successively, the highest price only on a small tonnage for spot shipment. Bessemer has not moved, the demand being chiefly for basic. We quote: Bessemer, $40@42; basic, $38@40; foundry and malleable, $38@40, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

Steel—While transactions that would show the market are few, it is clear that billets, sheet bars and rods are approximately $5 a ton higher, at $75@80 for billets and sheet bars and $85@90 for rods. Offerings are very limited.

Ferroalloys

Ferromanganese—Fears are entertained of further diminution in England's supplies of manganese ore, whereby deliveries of the alloy to this side would be further delayed and consumers might have to make purchases of domestic to eke out. Spot has advanced sharply, $400 being paid in at least one instance for more than a carload. We quote spot domestic at $350@400 and contract at about $300, with English nominal at $185@200 on contract.

Spiegeleisen—Spot, $75@80; contract, $60@65.

Ferrosilicon—Material, 50%, $175@225. Bessemer, 10%, $54.

Coke

Connellsville—This week's car supplies are better, but labor was very short on Monday, on account of the holiday, and not all the cars could be loaded. Prospects are uncertain and operators refuse to quote on contract furnace. We quote: Spot furnace, $8.25@8.50; contract, nominal, $7@8.50; spot foundry, $10@11; contract, $8.50@9, per net ton at ovens.

STOCK QUOTATIONS

N. Y. EXCH.†	Apr. 10
Alaska Gold M.	8
Alaska Juneau	7
Am.Sm.&Ref.,com.	98
Am. Sm. & Ref., pf.	112
Am. Sm. Sec., pf. A	100½
Am. Sm. Sec., pf. B.	96
Am. Zinc	34
Am. Zinc, pf.	67
Anaconda	78½
Batopilas Min.	1½
Bethlehem Steel	134
Bethlehem Steel, pf.	121
Butte & Superior	42
Cerro de Pasco	35⅜
Chile Cop.	22⅜
Chino	53⅜
Colo.Fuel & Iron	45⅜
Crucible Steel	60⅜
Dome Mines	16½
Federal M. & S.	13
Federal M. & S., pf.	38
Great Nor., ore ctf.	30½
Greene Cananea	40½
Homestake	127
Inspiration Con.	56
International Nickel	41⅛
Kennecott	42⅜
Lackawanna Steel	80⅛
Miami Copper	41⅛
Nat'l Lead, com.	55
National Lead, pf.	110
Nev. Consol.	22
Ontario Min.	5½
Quicksilver	2
Quicksilver, pf.	2½
Ray Con	29
Republic I.&S.,com.	76½
Republic I. & S. pf.	102½
Sloss-Sheffield	56⅛
Tennessee C. & C.	15
U. S. Steel, com.	108⅛
U. S. Steel, pf.	117⅛
Utah Copper	109
Va. Iron C. & C.	64½

N. Y. CURB†	Apr. 10
Big Ledge	3½
Butte & N. Y.	1
Butte C. & Z.	9½
Caledonia	.63
Calumet & Jerome	1½
Can. Cop. Corpn.	2
Carlisle	5½
Con. Ariz. Sm.	1⅛
Con. Coppermines	4
Con. Nev.-Utah	⅛
Emma Con.	1⅛
First Nat. Cop.	2⅜
Goldfield Con.	.61
Goldfield Merger	.07
Granite	‡ .25
Greenmonster	1⅞
Hecla Min.	7⅛
Howe Sound	6½
Jerome Verde	1
Joplin Ore & Spel.	.20
Kerr Lake	4⅛
Magma	46⅛
Majestic	.50
McKinley-Dar-Sa.	.49
Mother Lode	.32
N. Y. & Hond.	14
Nipissing Mines	7⅜
Ohio Cop.	1
Ray Hercules	3⅛
Rochester Mines	.54
St. Joseph Lead	17½
Seneca	1
Standard S. L.	.75
Stewart	⅛
Success	.40
Tonopah	6⅛
Tonopah Ex.	3⅜
Tribullion	⅛
Troy Arizona	.48
United Verde Ext.	38
United Zinc	5⅛
White Knob, pf.	1
White Oaks	1
Yukon Gold	1

SAN FRAN.*	Apr. 10
Alta	.03
Andes	.12
Best & Belcher	.06
Bullion	.02
Caledonia	.14
Challenge Con.	.05
Confidence	.10
Con. Virginia	.22
Gould & Curry	.03
Hale & Norcross	.06
Jacket-Cr. Pt.	.04
Mexican	.07
Occidental	.65
Ophir	.10
Overman	.03
Savage	.06
Seg Belcher	.02
Sierra Nevada	.11
Union Con.	.32
Utah Con.	.01
Belmont	4.15
Jim Butler	.68
MacNamara	.07
Midway	.16
Mont.-Tonopah	‡ .20
North Star	.15
Rescue Eula	.26
West End Con.	.66
Atlanta	.12
Booth	.09
Comb. Frac.	.04
D'field Daisy	.03
Florence	.22
Jumbo Extension	.44
Kewanas	.17
Nevada Packard	.44
Round Mountain	.44
Silver Pick	.13
Argo	.05
Ariz. Central	.10
Big Jim	.87½
Lazy Boy	.06
Nellie	.16
Tom Reed	2.00
United Eastern	4.62½

BOSTON EXCH.*	Apr. 10
Adventure	2⅜
Ahmeek	98
Algomah	.75
Allouez	61
Ariz. Com., ctfs.	12
Bonanza	‡ .25
Butte-Balaklava	1⅛
Calumet & Ariz.	78½
Calumet & Hecla	545½
Centennial	20
Copper Range	59⅞
Daly West	2
Davis-Daly	5
East Butte	13½
Franklin	7¼
Granby	85
Hancock	15½
Hedley	18
Helvetia	.35
Indiana	3
Island Cr'k, com.	65
Isle Royale	32
Keweenaw	2⅛
Lake	12
La Salle	‡3½
Mason Valley	5⅜
Mass	13
Mayflower	2½
Michigan	3⅜
Mohawk	83
New Arcadian	4
New Idria	16
North Butte	22
North Lake	1½
Ojibway	2½
Old Colony	2⅞
Old Dominion	59
Osceola	84½
Quincy	85⅞
St. Mary's M. L.	80
Santa Fe	1½
Shannon	8⅛
Shattuck-Ariz.	25
So. Lake	4
So. Utah	.21
Superior	11½
Superior & Bost.	5⅜
Tamarack	‡59½
Trinity	3⅛
Tuolumne	1⅞
U. S. Smelting	57⅛
U. S. Smelt'g, pf.	50⅜
Utah Apex	2⅛
Utah Con.	14⅜
Utah Metal	5
Victoria	4½
Winona	14
Wolverine	44
Wyandot	‡1

BOSTON CURB*	Apr. 10
Alaska Mines Corp.	1⅛
Bingham Mines	10
Boston Ely	.70
Boston & Mont.	.60
Butte & Lon'n Dev.	.24
Calaveras	4
Calumet-Corbin	.02
Chief Con.	2⅛
Cortez	.20
Crown Reserve	.31
Crystal Cop.	.89
Eagle & Blue Bell	2⅛
Houghton Copper	.99
Intermountain	1⅛
Iron Cap Cop., pf.	14
Mexican Metals	.18
Mines of America	1⅛
Mojave Tungsten	.38
Nat. Zinc & Lead	.50
Nevada-Douglas	2
New Baltic	1⅛
New Cornelia	17¼
Oneco	.50
Pacific Mines	.25
Rex Cons.	.34

SALT LAKE*	Apr. 10
Big Four	.86
Black Jack	.05½
Cardiff	5.00
Colorado Mining	.17
Crown Point	.04
Daly-Judge	8.25
Empire Copper	1.50
Gold Chain	.17
Grand Central	.51
Iron Blossom	1.10
Lower Mammoth	.03
May Day	.09
Moscow	.12
Prince Con.	1.20
Seven Troughs	‡ .02½
Silver-King Coal'n	2.95
Silver King Con.	4.02½
Sioux Con.	.12
So. Hecla	1.25
Uncle Sam	.03
Wilbert	.13½
Yankee	.10

TORONTO*	Apr. 10
Bailey	.05½
Beaver Con.	.30
Buffalo Mines	1.50
Chambers Ferland	.13
Coniagas	3.60
La Rose	.50
Peterson Lake	.11
Right of Way	.03
T. & Hudson Bay	40.00
Temiskaming	.50
Wettlaufer-Lor.	.06½
Dome Exten.	.21
Dome Lake	.19
Foley O'Brien	.60
Hollinger	5.20
Jupiter	.30
McIntyre	1.83
Newray	1.36
Porcu. Crown	.63
Schumacher	.55
Vipond	.44
West Dome	.27

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Apr. 10
Cresson Con.	5.75
Doctor Jack Pot.	.06½
Elkton Con.	.09¾
El Paso	.25
Gold Sovereign	.04½
Golden Cycle	2.25
Granite	.55
Isabella	.16
Mary McKinney	.25
Portland	1.75
United Gold M.	.16
Vindicator	‡ .70

LONDON	Mar. 29
Alaska Mexican	£0 12s 6d
Alaska Tre'dwell	2 15 0
Burma Corp.	3 15 0
Cam & Motor	0 7 9
Camp Bird	0 5 0
El Oro	0 7 0
Esperanza	0 7 9
Mexico Mines	4 2 6
Nechi, pfd.	0 13 0
Oroville	0 16 0
Santa Ger't'dis	0 9 6
Tomboy	0 19 6

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
January	48.855	56.775	75.630	22.731	26.960	36.682
February	48.477	56.755	77.585	22.753	26.975	37.742
March	50.241	57.935	73.861	23.708	27.597	36.410
April	50.250	64.415		23.709	30.662	
May	49.915	74.269		23.570	35.477	
June	49.034	65.024		23.267	31.060	
July	47.519	62.940		22.597	30.000	
August	47.163	66.083		22.780	31.498	
September	48.680	68.515		23.591	32.584	
October	49.385	67.855		23.925	32.361	
November	51.714	71.604		25.094	34.192	
December	54.971	75.765		26.373	36.410	
Year	49.684	65.661		23.675	31.315	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan.	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar.	26.310	31.481	107.714	136.750	136.000	151.000
April	27.895		124.319		137.389	
May	28.625		135.457		152.522	
June	26.601		112.432		137.455	
July	23.865		95.119		125.500	
Aug.	26.120		110.283		126.304	
Sept.	26.855		113.905		134.071	
Oct.	27.193		122.750		142.523	
Nov.	30.625		134.659		155.432	
Dec.	31.890		145.316		162.842	
Year	27.202		116.059		138.281	

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741	54.388	193.609	207.443
March	51.230		199.736	
May	49.125		196.511	
June	42.231		179.466	
July	38.510		168.357	
August	38.565		169.870	
September	38.830		171.345	
October	41.241		179.307	
November	44.109		186.932	
December	42.635		183.368	
Av. year	43.480		182.096	

Lead	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.500
March	7.136	9.199	7.375	9.120	34.440	30.500
April	7.630		7.655		34.368	
May	7.463		7.332		32.967	
June	6.936		6.749		31.011	
July	6.352		6.185		28.137	
August	6.244		6.088		29.734	
September	6.810		6.699		30.786	
October	7.000		6.898		30.716	
November	7.042		6.945		30.500	
December	7.513		7.405		30.500	
Year	6.858		6.777		31.359	

Spelter	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
Jan.	16.915	9.619	16.745	9.449	89.810	48.329
Feb.	18.420	10.045	18.260	9.875	97.762	47.000
Mar.	16.846	10.300	16.676	10.130	95.048	47.000
April	16.695		16.525		99.056	
May	14.276		14.106		94.217	
June	11.752		11.582		68.591	
July	8.925		8.755		50.750	
Aug.	8.730		8.560		51.587	
Sept.	8.990		8.820		52.095	
Oct.	9.829		9.659		54.159	
Nov.	11.592		11.422		56.023	
Dec.	10.665		10.495		55.842	
Year	12.804		12.634		72.071	

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. ¦ Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30.95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81	37.37	19.20	33.49	19.45	35.91
April	21.65		18.95		19.45	
May	21.78		19.11		19.58	
June	21.95		18.95		19.34	
July	21.95		18.95		19.20	
August	21.95		18.95		19.22	
September	22.88		19.58		19.53	
October	24.61		21.26		21.51	
November	30.07		28.18		26.55	
December	35.16		30.95		30.79	
Year	$23.88		$20.98		$21.15	

‡ As reported by W. P. Snyder & Co.